DEBIPRASAD CHATTOPADHYAYA

HISTORY OF SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

II FORMATION OF THE THEORETICAL FUNDAMENTALS OF NATURAL SCIENCE

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History of Science and Technology In Ancient India

Formation of the Theoretical Fundamentals of Natural Science

Debiprasad Chattopadhyaya
(*with invited contributions*)

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Aid to the reader

1. The book is divided into two parts. The first part contains the main body of the text. While working on it, it was felt that certain questions raised in the book were in need of more detailed discussion. Hence I approached some specialists to contribute more or less detailed discussions of a number of problems so that long digressions into these could be avoided in the body of the book. Their contributions are given here in the form of a number of *Appendices*. In total bulk the bunch of the *Appendices* turned out to be considerable. The Appendix on *Syadvada* consists of the reprints of some relevant discussions published earlier.
2. Since each *Appendix* contains in full its own notes and references these are not repeated in the *Bibliography* of the text itself.
3. Diacritical marks for Indian words could not unfortunately be used in the book. However, only in one place (p. 178) it proved indispensable, that is for distinguishing between *karana* and *kaarana* : double *aa* instead of long *a* is used for the purpose.
4. The references in the footnotes of the main text are cited by the author's name, followed—where necessary—by the initial letters of the title in Roman Capitals, figures indicating page (and Volume) number or numbers. Titles of well-known Sanskrit texts like the *Upanisad*-s etc. are mentioned in their standard abbreviations.

BACKGROUND NOTE

ASHOK JAIN

Director NISTADS

Professor Debiprasad Chattopadhyaya's contribution to the understanding of Science-In-Society signals a creative fluctuation around which a rich knowledge system is getting organised—the earlier volume 'History of Science and Technology in Ancient India—The Beginnings' and the present volume being magnificent parts of it. The project is sponsored by the National Institute of Science Technology And Development Studies (NISTADS), a constituent establishment of the Council of Scientific and Industrial Research (CSIR). The genesis of these projects is already given as *Background Note* to the first volume. I would like to believe that by sponsoring these projects NISTADS is humbly contributing to a 'niche' in which these and many more Science-In-Society studies will grow. As project-in-charge, Professor Chattopadhyaya has taken full responsibility of the work, discussing it with a large number of scholars, selecting the invited contributors and the publisher. NISTADS would like to express its appreciation to Professor Chattopadhyaya and to all those who have made this volume possible. On behalf of NISTADS I thank the readers and the critics who received Debida's first volume so enthusiastically. I look forward to their equally enthusiastic attention to the present volume.

November 1990 Ashok Jain

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For the laborious work of preparing the Index I am indebted to Sm. Yangchen Bhutia, M. A. and Dr. Sanjit Sadhukhan.

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AUTHOR'S PREFACE

The present work is a sequel to my *History of Science and Technology in Ancient India* : *The Beginnings* (Calcutta 1986, with a Foreword by Joseph Needham). It may be convenient specially for those who have not gone through it to introduce the main theme of the present volume with a brief recapitulation specially of two points sought to be discussed in the earlier one.

The first of those is concerning the broad and revised periodisation of the history under review. The second one is about the nature of the earliest science.

With the archaeological excavations beginning from the third decade of the twentieth century, the need was felt for a radical revision of the general framework of the history of the ancient Indian subcontinent. The earlier historians were under the necessary obligation of beginning practically every aspect of this history with what they could read in the Vedic literature, for no other data were then available to start with. But the archaeologists' spade has dismantled this limitation. It dug up the outlines of an imposing earlier civilization with a considerable number of flourishing cities. This is conventionally referred to as the Indus Valley civilization, reaching its peak long before the making of the Vedic literature. Its more prominent centres came to their end roughly in 1750 B.C. for complex reasons the nature of which the archaeologists are still trying to ascertain. However, they are agreed that this civilization represented the period of our First Urbanization. Its end was followed by a technologically fallow period stretching over about a thousand years—a period of 'reverting to the preliterate peasant communities'. Hence archaeologists often call it the Dark Age or the Dark Period. Then, roughly from 700 or 600 B.C. was foreshadowed a new turn towards building up the city life again, which soon took a clear shape and hence is characterized as the turn to the Second Urbanization.

The three periods are thus broadly termed as those of—

I. The Period of First Urbanization,
II. The Intervening Dark Age, and
III. The Period of Second Urbanization.

Following the lead of Gordon Childe, the First Urbanization is viewed as resulting from the "urban revolution" or the profound socio-economic transformation that enabled man to move forward from the neolithic villages to city life in the full sense. The three primary centres of this in the Old World were Egypt, Mesopotamia and the Indus Valley.

An important trait of the urban revolution, as Childe has shown, was the creation of exact and predictive sciences. This concretely meant the making of mathematics and astronomy. From documents deciphered these two sciences are directly evidenced in Egypt and Mesopotamia. In the Indus Valley civilization we have no such direct evidence, an important reason of which is that the Indus script yet awaits decipherment. Still from a considerable number of circumstantial evidences—aided by what we have proposed to call the method of retrospective probing—we have enough to infer that mathematics and astronomy came into being also in the third primary centre of the urban revolution

Our present study in the history of science in the ancient Indian subcontinent wants to take off from this point. One of the crucial questions we felt confronted with is : why was it that Childe, while speaking of the coming into being of exact and predictive sciences in the First Urbanization, spoke *only* of mathematics and astronomy, excluding by implication what we call rational natural science ? The answer evidently is that it was not there in the First Urbanization. But what accounts for its absence ? Evidently, again, the answer is that there was also something in the First Urbanization that must have inhibited its possibility.

It is here that the study of the Second Urbanization in the ancient Indian subcontinent—mainly to the period of the formation of which we shall keep ourselves confined in the present work—proves specially fascinating. Whatever might have eventually happened in Egypt and Mesopotamia, rational natural science did come into being during our Second Urbanization, and this, as we shall see, with a remarkable promise. This could be possible because the factors inhibiting it during the earlier period must have been at least considerably weakened, making room for a new intellectual climate. But we have to go outside the area of the intellectual climate itself to seek clues to its change, and these we have sought to identify in the changing administrative infrastructure ultimately resulting in the Second Urbanization. The point however is not to be misunderstood. Forces inhibiting rational natural science in the First Urbanization were not fully washed out. Only these were pushed to a secondary position, leaving scope for their reconsolidation and reassertion evidently in a new form only a few centuries later that could and did stifle the wonderful possibilities of natural science. Secondly, the making of rational natural science was not really accidental. The soil in which it could take roots had to be prepared first. The need was felt for this by way of probing into various new directions to understand the mystery of man and nature. Such probings evidently resulted in glimpses of the nature of the ultimate cause—glimpses that remained fragmentary and at best partial. But already in the literature codified in the eighth or seventh century B.C. we come across a remarkable person in whose understanding rational natural science assumed a spectacular form—*i.e.* spectacular judged in the standard of his age. His name comes down to us as Uddalaka Aruni. At least two features of his achievements need to be specially noted. For all that we know, he was the first in global history to formulate and apply the essentials of the method of experimental verification—a method that retained significance for many centuries to follow. Secondly, he developed in a rudimentary form though, a very promising unified theory of man and nature having far-reaching consequences for the history and philosophy of science. At the same time we had to note the reasons for the unfortunate distortions of his views stretched over many centuries that have prevented even the most outstanding of the later scholars to see the science-potentials in Uddalaka's views for a very long time, leaving only a handful of recent ones the bold task of reassessing these.

Both the methodology of Uddalaka and his unified view of man and nature, we have ventured to presume, contributed to the making of the tradition of rationalist medicine in the ancient Indian subcontinent. Here, however, we are confronted with some special problems. The form in which the source-books of rationalist medicine reach us, is, to say the least, most quaint. In these rational science is freely mixed up with a huge heap of counter-science. This has obliged us to go in not only for a critical analysis of the texts but also to try to identify the causes that eventually gave these their present quaint form. While attempting this, we had to return basically to the same factors—though now in a new form altogether—that inhibited the possibility of rational science in the First Urbanization. Rationalist medicine aspired after being too severely scientific to be tolerated by the general administrative infrastructure of the new situation in the Second Urbanization though as an auxiliary force. It was felt that for the purpose of keeping the masses under control even in the new situation certain ideas and attitudes going against science had to be enforced on the consciousness of the people. Rationalist medicine, flouting these for the sake of science, thus came under strong condemnation specially in the legal literature that took full shape with the consolidation of royal power in the Second Urbanization. Those through whose hands the source-books of medicine passed before assuming their present form wanted to evade the censorship of the makers of the law-codes and this by way of recklessly dumping elements of orthodox piety on these, irrespective of the consideration of the inner consistency of the works. I have, in one of my own earlier works (*Science and Society in Ancient India,* Calcutta 1977) tried to argue all these in details, much of which I felt obliged to repeat in the present book for the simple reason that the theoretical fundamentals of science in ancient India remains absurdly inadequate without taking note of the fundamentals of rationalist medicine in which rational science reached its climax as it were.

Introducing the main theme of the present book could have ended here but for a few considerations.

One of the main sources for the period covered in the present book is the encyclopaedic work that comes down to us as the *Arthasastra* of Kautilya. I had originally the intention of reviewing it specially from the viewpoint of technology. However I found my young friend Dr. Ranabir Chakravarti substantially covering the theme in his article which appears here as *Appendix I*. This is one of the reasons for not reiterating some of the important features of the work. Not that Chakravarti's article is a comprehensive survey of the technological contents of the *Arthasastra*. But such a survey actually requires considerable space which, I have eventually felt, may as well form the subject matter of a separate monograph altogether. This is another reason leading me to leave the *Arthasastra* apart.

There is perhaps a third reason for this. I have preferred rather to concentrate mainly on the medical compilations which, as far as I understand, contain the norm of science in its proper sense. Scientific knowledge brings power. But it may be the power for extending benefits to mankind just as it may also be the power to exploit and keep men under control for the benefit of the ruling minority. While the medical compilations exemplify the former, the *Arthasastra* the latter. From this point of view, any tendency to overvalue the scientific contents of the *Arthasastra* is likely to prove to be an error.

A few more points may as well be clarified here.

First, while elaborating the methodology of natural science, rationalist medicine had to go into much details of the problems of epistemology which formed the special theme of the philosophical system later known as the Nyaya. Similarly, in developing the unified view of man and nature, the representatives of rationalist medicine found themselves obliged to depend on a number of "categories", in terms of which nature could be systematically understood. These categories, however, formed the special theme of a system of philosophy, which we are later accustomed to call the Vaisesika. The discussion of the Vaisesika philosophy, again, remains incomplete without a survey of the atomic hypothesis, which in later times is considered absolutely essential for it. Thus, in short, the discussion of the theoretical fundamentals of natural science remains incomplete without raising the question of their relation to the philosophical situation of ancient India. Because of this consideration we felt obliged to digress into questions that are generally considered as 'philosophical' in the restricted sense.

Secondly, the general planning of the book requires to be clarified. The book is divided into two main parts—the first embodying its main theme or argument and the second a number of *Appendices*. Such a division is necessitated by two main reasons. The first of these is consideration of procedural advantage. While working out the main argument, it is felt that certain points on which it is based require more or less longish discussions, sometimes inclusive also of prevailing controversies about these. If the readers are required to digress into all this, they are likely to lose the main thread of the central argument or return to it not without straining for recalling the context that required such digressions. Accordingly it was felt that such details are better covered in the form of separate *Appendices*. The *Appendices* proved essential for substantiating the main line of argument.

But there is a more important consideration for giving the *Appendices* separately. Working on the history of science and technology in ancient India is not one man's job—not surely of an individual of my calibre. It presupposes the cooperation of a number of researchers with specialized knowledge of many a related question that cannot but arise in the course of working out its central theme.

Hence I felt obliged to approach a number of scholars, inviting from them contributions covering the area of their specialization. The response I have received from them proved most encouraging. But I must at once be clear about one point. I have received these invited contributions from the experts without any commitment on their part to my central argument. The responsibility of the basic argument of the book—like that of its errors—is exclusively mine. The scholars who have been generous enough to respond to my request for contributing the *Appendices* to the book do by no means share my personal shortcomings. The only way in which the invited contributors are connected with the present work is their graciousness prompting them to add to it the specialized knowledge they possess.

It needs to be added in this connection that invited contributions apart, a few of the *Appendices* are but verbatim reprints of some materials already published in some books and journals. The consideration leading me to add these to the *Appendices* is their obvious relevance for the main theme of the book. These reprints pertain specially to the tricky question of the science potentials of the neo-logic called *syadvada* developed by those that professed Jainism as their creed. I could hardly afford to ignore these specially because scientists as eminent as P. C. Mahalanobis, J. B. S. Haldane and D. S. Kothari came out with their comments on the topic. But I also thought that it could be relevant to preface their writings with an account of how our traditional scholars propose to explain the significance of this logic. Hence the bunch of papers on *syadvada* is introduced by one from Pandit Sukhlalji Sanghvi, by far the greatest authority on Jainism, which some years back he contributed on my special request to the Indological Quarterly I was then editing—*Indian Studies: Past and Present.* I passed on the entire bunch of papers on *syadvada* to the eminent physicist Partha Ghose for his summing up of the discussions and comments. Being a close friend of mine he could not refuse.

But I am under the obligation to mention a point about Appendix IX in particular. It has been contributed on my special request by S. Kalyanaraman. His interest in the subject is testified above all by the stupendous *Bibliography* he has given. By profession, however, he is the Assistant Controller of the Asian Development Bank. But I was asked very categorically to mention that nothing that he has said in this *Appendix* is connected with his professional career—the Asian Development Bank, in other words, is in no way to be connected with his dissertation, which embodies research in his purely personal capacity.

I would further like to be clear about one point of his contribution. When I first requested him to contribute an appendix on alchemy and chemistry in ancient India—a subject on which he has been working for so many years—I received a response from him in the form of a monograph which in bulk would have been perhaps longer than my own work itself. For consideration of space it could not be included in the present publication. So I had to re-request him to shorten his main points only in a few pages, barely skeletal though it may appear compared to his original contribution. In the present book is incorporated only this summary of his main points. At the same time, I have felt that his stupendous bibliography on the subject should prove of immense value to further research. Hence the entire bibliography is reproduced at the end.

As for the other contributors to the *Appendices,* I have already mentioned their professional backgrounds (excepting those of P. C. Mahalanabis, J. B. S. Haldane, Pandit Sukhlalji Sanghvi and E. E. Obermiller).

CHAPTER 1

SCIENCE UNDER SURVEILLANCE

1. PRELIMINARY REMARKS

In Gordon Childe's analysis, as already seen,[1] one trait of the Urban Revolution was the creation of "exact and predictive sciences." It needs, however, to be noted that in this connection he spoke only of arithmetic, geometry and astronomy, and even these, as we shall presently see, not without any restriction imposed on these. Still, the making of mathematics and astronomy in the First Urbanization is indisputable. These are directly attested to by documents deciphered in Mesopotamia and Egypt. In the third primary centre of the First Urbanization, the ancient Indus Valley, we are yet to have such direct documentary evidence. The Indus script remains to be deciphered. Still the admission of mathematics and astronomy in the Indus Valley civilization cannot be ruled out. We have attempted to show this depending mainly on what we have proposed to call the "method of retrospective probings". This is further substantiated by a number of direct circumstantial evidences. Thus what is clear about the other two primary centres of the Urban Revolution cannot be set aside by what is yet obscure in the third, specially when the present obscurity is due to *our failure* to decipher the script. We shall later see how crucial is this argument for certain other matters concerning the Indus Valley civilization.

But let us turn to another question which cannot be evaded in this connection. How was it that the First Urbanization created *only mathematics and astronomy*, excluding by implication *rational natural science*, by which we understand the *view of nature as it is without any alien addition* and this based on empirical data processed by reason uninhibited ?

The question acquires special significance for the history of the ancient Indian subcontinent. Whatever might have happened in later Egypt and Mesopotamia, rational natural science did come into being in India and this with an amazing promise. But it happened much later—about a thousand years after the end of the imposing Indus cities—and also in a changed venue, in the Ganga Valley. This is sometimes referred to as the Second Urbanization in ancient India. Nevertheless, this evidence of the spurt of rational natural science in India is of much importance notwithstanding the temporal and spatial gap between the First and the Second Urbanization, inasmuch as it goes to show that any assumption of the intellectual soil of India having been inherently sterile for the growth of rational natural science is simply gratuitous—an assumption which is implicit or explicit in the writings of some historians of science. The presumption, on the contrary, is that there must have been something in the First Urbanization which allowed science to develop only in certain restricted directions. Evidently, again, there must have been something in our Second Urbanization which removed such restrictions. But this means that the factors accounting for the course of scientific developments are to be sought not *within* science itself but *outside* it. No history of science can be sufficiently scientific so long as it does not identify such factors.

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[1] See *Science and Technology in Ancient India : The Beginnings*, Calcutta, 1986.

Here is thus a problem we have to face at the very first step of our present enquiry. What was it in our First Urbanization that prevented science to develop in the direction of a rational and natural one and how was it possibly removed in the period of the Second Urbanization ?

2. SCIENCE IN FIRST URBANIZATION

The question of the First Urbanization first.

Arithmetic, geometry and astronomy came into being in the earliest cities, because these were *needed to meet certain inner requirements of the urban revolution with the added advantage of cohering with the essential ideological demand of the same revolution.* By contrast, in spite of the fact that the basic technological prerequisites for rational natural science were fulfilled already on the eve of the urban revolution, the possibility of its making—along with its methodology—was inhibited, because it could not but be in confrontation with the essential ideological requirements of the same revolution. The urban revolution, in other words, carried an inner contradiction, requiring science as well as its opposite—a contradiction aptly referred to by Childe as the "dialectics of progress."[2] The contradiction was resolved by putting restrictions on the aspirations of science.

What, then, was it about the urban revolution that required exact and predictive sciences, though only in some restricted forms ?

Arithmetic was needed in the earliest cities to maintain inventories of the revenue and other properties of the temples, such as food stored in the granaries to feed whole-time specialist-craftsmen so essential for the cities. It was perhaps also required for book-keeping of the merchants and traders, who, it is sometimes presumed,[3] were under the tutelage of the priests or priestly corporations that actually ruled the cities as mundane representatives of the goddesses and gods to whom the cities were supposed to belong.

Geometry must have been required specially by the architects, engineers and other technicians for the construction of the monumental structures—the ziggurats, pyramids, temples, palaces, etc. —and, as in Mohenjodaro, the "Great Bath", the imposing granary and the more imposing town-planning as well as the highly sophisticated brick-technology that still amaze us.

The need for some astronomical knowledge was there, if for no other reason than the preparation of a farmer's calendar that could predict, among other things, the coming of the floods and of the season for preparing the soil for sowing. Without it, successful agricultural operation was inconceivable—as inconceivable indeed as the thriving of the earliest cities without city administrators being able to channelize the agricultural surplus of the nearby direct producers to fill the granaries of the growing cities.

Before proceeding further, we may as well try to be clear about one point. What we are concerned with is specially the question of the ancient Indus Valley civilization. Despite conjectures and controversies among the modern researchers, we have no direct and definite knowledge about the administrative infrastructure of the Indus civilization. Still, arguing again on the basis of the assumption that what is clear cannot be set aside by the obscure, we presume it must have been broadly similar to the other two primary centres of the urban revolution, namely, Egypt and Mesopotamia. These two, as attested to by definite and deciphered evidences, were ruled by the priests or their corporations. Hence had been the need of massive superstitions in the administrative infrastructure of the two. With this point in mind, we may as well pass on to what is known in general about our First Urbanization.

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[2] G. Childe MMH 236.

[3] D.D. Kosambi ISIH 62.

Arithmetic, geometry and astronomy as sciences were thus needed to meet the inner requirements of the urban revolution. As sciences, these had, however, a peculiarity of their own : they could be construed to cohere with the belief system equally essential for the same revolution.

What, then, was the nature of this belief system ? In simple language, it was superstition officially sanctified. An absolute faith in the goddesses and gods to whom the cities were supposed to belong and who moreover were assumed to govern the destiny of the human beings—was an essential prerequisite for the ideological cohesion of the growth of the first cities. Concretely it meant submission to the authority of the priests and their corporations, who alone were expected to know how to please or placate the deities or even magically to coerce them to fulfil human requirements. . ..

A total faith like this could make the channelization of the surplus to the city granaries attached to the temples a rather simple process. On the one hand, offering the surplus to the deity helped the peasants to earn piety. On the other, the wrath of the deities, if not pleased or placated, left the entire area exposed to calamities like drought or plague.

Their faith thus gave the priests an absolute and inviolable authority. Under the given conditions, therefore, superstition on a grand scale was a historical necessity. As Farrington[4] has very aptly summed up :

> Gigantic works in brick or stone witness to the power of government to direct co-operative efforts of vast populations. Ziggurats, pyramids, temples, palaces, colossal statues—the dwellings, tombs, and images of kings and gods—apprise us of the organizing ability of the great, the technical skill of the humble, *and the superstitions on which society was based.*

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[4] B. Farrington GS 34. Emphasis added.

It now remains for us to see how far mathematics and astronomy, in spite of aspiring to be exact sciences, had the added advantage of being accommodated within the general framework of this ideological requirement.

3. SCIENCE WITHOUT DISTURBING THE UNIVERSE OF THE PRIESTS

In the first cities, astronomy and mathematics were yet to assume the form of being too severely scientific to go against the officially accepted ideology. There is rather the scope to think that these could be used directly or indirectly to add to the grandeur of the administrative authorities. Being elites *par excellence*, the priests were presumably the custodians of whatever astronomical and mathematical knowledge then developed. Further, it is not difficult to see how this knowledge could add to the awe and veneration for them and thus strengthen their power.

The question of astronomy is perhaps more readily understood. As a matter of fact this seems to be directly attested to by the circumstance sometimes noted that the earliest "observatories"—rudimentary though—were attached to the temples.[5] But the more important point seems to be that the heavenly bodies whose observed movements formed the basis of the early calendrical sciences—the sun, moon and asterisms—were then conceived not as material or natural entities but as veritable deities or at least as having deities to preside over them.[6]

Such deities, far from coming in to confrontation with the magico-religious beliefs sanctified by the city administrators, could smoothly cohere with them. Thus the knowledge of the heavenly bodies controlling human destiny added to the awe for the city administrators, who alone had direct knowledge of the deities as heavenly bodies.

It is thus not difficult to conceive why astronomy was not only required by the urban revolution for directing the work of the primary producers but also had the advantage of enhancing the prestige of the governing priests : the wisdom they possessed must have been viewed as something supernatural or supernormal.

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[5] Stencel *et al* in *Science* 23 July 1976.

[6] It is because of flouting this that Plato in *Laws* looks back with horror at the early Ionians. See G. Thomson FP 323.

One is tempted to recall[7] here what happened to the Egyptian king Amenhotep IV, a pharaoh of the eighteenth dynasty (about 1372 to 1354 B.C.), who "chanced, by the rarest of chances to develop a taste for some kind of quasi-physical understanding of the sun, a heavenly body. He wanted to view the sun more as a sun-disc than a god pure and simple. This led him to change his own name into Akhnaton—substituting *aten* for *amon*—the former meaning something akin to the sun-disc, the latter simply the spirit of the sun.

To us, the shift in meaning may appear to be rather trifling. But not to the ancient Egyptians. This was upsetting the belief system on which thrived the priests, and hence also their power, and in the given circumstances, even the hopes and aspirations of the common people accustomed to the belief in the sun-god. It was thus nothing short of a heresy, in celebration of which the king founded, in the plain of Amarna, the City of the Sun's Horizon.

Being all-powerful after all, he simply decreed his new understanding, outlawing all older views. Nothing could be done, of course, so long as he lived : the will of the pharaoh was paramount. With his death, however, the pent-up vengeance of the priests gushed out, and this evidently with the support of the people who, deprived of their old trusted god, felt naked before the forces of nature ; they were alarmed at being taken too suddenly away from their familiar beliefs, specially when the material conditions were not created to relieve them of avoidable sufferings. Even the rudimentary medical knowledge then developed remained part of priestly secret.

After Akhnaton passed away, the City of the Sun's Horizon was razed to the foundations and his very name was erased from the calendar of kings. Where it appears, if at all, it occurs as "that criminal of Amarna". His successor reverted to the old *amon*, changed his own name from Tutankaten to Tutankhamon and was celebrated as the restorer of the original faith.

Such then is one example of the strength and tenacity of the ancient astronomical view freely reconciling itself with magico-religious ideas : even one of the mightiest powers then in the world had to face posthumous consequences for his peculiarly unexpected enthusiasm to give a somewhat minor or quasi-physical tilt to it.

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[7] B. Dunham HH 3ff.

One is tempted also to recall here of what happened in our neighbouring country to Ulugh Beg[8] (A.D. 1394-1449). A grandson of the Asian conqueror Timur, he was made the ruler of Samarkand with an army under his command. By a rare chance, again, in spite of his royal background, he developed an all-absorbing interest in astronomy, even built an observatory at Samarkand (A.D. 1428) for accurate observations of celestial bodies and found many an error in the computations of the ancient astronomer Ptolemy. But such a zeal for an objective understanding of the heavenly bodies proved awkward and even uncomfortable for the custodians of the prevailing religious beliefs. As a consequence, the priests intrigued against him, cut him off from his own army and murdered him.

When a pharaoh like Akhnaton or a prince like Ulugh Beg was not spared for interfering with the religious beliefs with which earlier astronomy was intertwined, it is not difficult to imagine what a formidable task it proved much later for astronomy to develop into a natural science. But as long as astronomy remained under the custody of the priests and embedded in religion and mythology—a matter of the deities, with whom the priests were in best terms, there was no such problem. Such a situation prevailed in the earliest cities where astronomy as science was needed and even allowed to develop, though on condition that it did not disturb the ideological coherence—which meant massive superstition—essential for the making of the earliest cities.

Leaving astronomy, we now pass on to the other science which was also required by the urban revolution and could be somehow viewed as cohering with its ideological requirements. This was mathematics.

Arithmetic first. Its need for the urban revolution is already noted. What is necessary here is to add another point. From its early inception it bore a patently preistly stamp. Some of its basic terminologies were "borrowed from the language of liturgy and magic ; the Akkadian word for 'working out a sum' is the same as that for 'performing a ritual act'."[9] Even the sophisticated Greeks were yet to outgrow the esoteric mystification of the numeral notations. Among the Pythagoreans, for example, the enthusiasm for this reached such a stage that it led the Hegelian historian of philosophy, Schwegler, to the exasperated expression "*arithmetical mystic*" indulging in "phantasies of a fanaticism at once unbridled and cold".[10]

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[8] *Soviet Encyclopaedia, s.v.*

We have added emphasis to the expression "arithmetical mystic" above because it aptly shows how arithmetic, notwithstanding its accuracy, is also amenable to mystification. Historically, however, the question remains : from where could Pythagoras imbibe the tendency of forcing arithmetic into the general framework of mystification ? Hegel answered the question, evidently considering it important enough to repeat it in different contexts. Wanting to reconstruct the biography of Pythagoras from the writings of the ancient authorities, he remarked, "As Pythagoras travelled with a scientific purpose, it is said that he had himself initiated into nearly all the mysteries of Greeks and of Barbarians, and thus he obtained *admission into the order or caste of the Egyptian priesthood*".[11] Again, since the view of the transmigration of the soul first flourished in Greek thought among the Pythagoreans, Hegel, while seeking for its real roots, observed, "As in the case of the brotherhood copied from the Egyptian priesthood, so must we here set aside this oriental and un-Greek idea of the transmigration of souls. Both were far too removed from the Greek spirit to have had a place and a development there".[12]

All this brings us back to the main question we have been discussing. The general theoretical climate of the First Urbanization, while needing arithmetic for its inner requirements, also could keep it restricted under the surveillance of superstition or religious mysticism.

Leaving arithmetic, we now pass on to the other branch of mathematics, namely geometry. We have already seen how the practical requirements of the urban revolution must have gone to its making. Our present question, however, is : How far could geometry, in spite of being a science, be compatible with the essential ideological requirements of the earliest cities?

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[9] G. Childe WHH 136.

[10] A. Schwegler GP 15.

[11] G. Hegel HP i. 197.

[12] Ibid. i. 234.

To begin with, there is a simple commonsense point to be noted. To the general masses of men and women, geometry must have been a body of strange figures, too abstruse or mysterious to be easily understood. The real significance and efficacy of it was known to the highest elites, the priests and their corporation.

At the same time, geometry was risk-free for the city administrators. It all depended on the way of looking at it. We have here again the testimony of a very sophisticated Greek philosopher who insisted that the right way of looking at geometry was to take it to the dizzy heights of pure speculation, from where it could have nothing to do with the material world or nature and so could not interfere in any way with the state of affairs here. Thus, Plato showed much enthusiasm for geometry, though on the strict condition that it was to be shorn of all connections with the material world. "Plutarch relates that he (Plato) criticised those mathematicians who tackled the problem of the duplication of the cube by making physical models, for 'the good of geometry is thereby lost and destroyed, as it is brought back to the things of sense instead of being directed upward and grasping at eternal and incorporal things'."[13]

Bearing in mind Hegel's reconstruction of the biography of Pythagoras, in which emphasis is put on the fact that Pythagoras himself was admitted into the caste or order of Egyptian priesthood, we may quote at some length Farrington's lucid description of how Pythagoreanism wanted mathematics as genuine science to cohere smoothly with religious superstitions. Observed Farrington:

> Pythagoras, however, as we have said, was not only a religious reformer and politician, but a scientist. We shall understand his science better if we do not forget his religion and his politics, for they were intimately blended. The Pythagorean community was a religious brotherhood for the practice of asceticism and the study of mathematics. The brethren were required every day to conduct, in private meditation, an examination of conscience. They believed in the immortality of the soul and its transmigration; the perishable body was but a tomb or prison which the soul inhabited for a time. These beliefs they held in common with other adherents of the mystery religions then wide-spread in Greece.

[13] M.I. Finley 112.

Pythagoreanism was, in effect, a sophisticated form of mystery religion. The peculiarity of the system was that it found in mathematics a key to the riddle of the universe and an instrument for the purification of the soul. 'The function of geometry,' says Plutarch, speaking like a good Pythagorean, 'is to draw us away from the sensible and the perishable to the intelligible and the eternal. For the contemplation of the eternal is the end of philosophy, as the contemplation of the mysteries is the end of religion.' The parallel is significant. The Pythagorens were the originators of the religious attitude towards mathematics. They did not indeed, at least in the earlier generations of the school, despise the practical applications of mathematics. Systematic town-planning, which began in Greece at this period, is due to Pythagorean influence. But the growth of religious mysticism based on mathematics must be ascribed to this school. The school quickly registered remarkable advances in geometry and the theory of numbers. It is generally agreed that by the middle of the fifth century they had arrived at most of the results which are systematized by Euclid in Books I, II, VII, and IX of his *Elements*. This is a scientific achievement of the first order. But if you study their mathematics in the sober pages of Euclid's famous textbook, you will not recover its other aspect, the religious fervour with which their views were held. A quotation from a fifth-century Pythagorean will help us to do that.

'Consider,' exclaims Philolaus, 'the effects and the nature of number according to the power that resides in the decad. It is great, all-powerful, all-sufficing, the first principle and the guide in life of Gods, of Heaven, of Men. Without it all is without limit, obscure, indiscernible. The nature of number is to be a standard of reference, of guidance, and of instruction in every doubt and difficulty. Were it not for number and its nature, nothing that exists would be clear to anybody either in itself or in its relation to other things...... You can observe the power of number exercising itself not only in the affairs of demons and of gods, but in all the acts and the thoughts of men, in all handicrafts and in music. Nor does harmony and the nature of number admit of any falsity. Falsity is in no way akin to it. Only to the unlimited, the unintelligible, the irrational, do falseness and envy belong.'[4]

Thus stripped of all connections with the world of the senses, geometry could and did acquire a form of mystification easily agreeing with the general tendency of the Platonic philosophy, which was basically averse to the material world, except of course to the problem of keeping the masses under control.

We have no evidence of how much Plato was directly influenced by the Egyptians in taking such a view, though it is known that

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14. B. Farrington GS 44-6.

in his maturest work, *The Laws*,[15] he wanted to look back at the petrified Egyptian culture[16] to illustrate how an effective use of massive propaganda could keep the masses cowed down by patent superstitions, i.e. what Plato, already in his *Laws*,[17] called "beneficial falsehood"—beneficial for administrative purposes irrespective of the question of truth. How far the view of geometry mystified to the extent of having nothing to do with the material world was connected to such "beneficial falsehood" may be a different question. This much, however, is known to all students of the history of philosophy that Kant had to argue hard against the Platonic tendency to purge geometry of all connections with sense-experience.

But all this forms part of the sophisticated philosophical debate of much later period. What concerns our immediate discussion is a simpler point. There was scope for understanding—or better, misunderstanding—geometry as a science that least disturbed the existing state of affairs in society at large. It could even be mystified to the extent of cohering with the ideological requirements essential for urban revolution.

To sum up : Astronomy and mathematics could and did develop in the earliest cities not only because these were required by the inner needs of the urban revolution but further because these—specially at the earlier stage of their making—had the advantage of cohering with the ideological inperative of the same revolution.

4. RATIONAL NATURAL SCIENCE

Emphasizing the importance of the ideological cohesion essential for the urban revolution, Childe observed, "there could be no room for sceptics or sectaries in the oldest cities."[18] The superstitions sanctified in the administrative infrastructure of these cities were not optional. They were mandatory for all.

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[15] Cf. G. Thomson FP 325 : "Some scholars have sought to extenuate Plato's educational programme on the ground that, when he wrote the *Laws*, he was a disillusioned and embittered old man. This is true enough, but it should not be overlooked that his disillusionment resulted from his failure to realise in practice the very similar ideas which he had already advocated in the *Republic*."

[16] G. Thomson FP 324.

[17] 663d-4a.

[18] Childe in *Town Planning Review*, reprinted in Possehl 17.

With this point in mind, we may now turn to consider the case of ratural national science. Our question is : How far is it at all conceivable as agreeing with the theoretical climate of the First Urbanization ? The answer is clearly in the negative. Not that it is easy to have an exact definition of natural science. But there is no scope to deny the basic fact that its first precondition is to *understand nature as it is without any "alien addition"*—the latter primarily meaning the goddesses and gods, and the alleged technique of placating or even magically coercing them being but priestly secrets.

Rational natural science could thus develop only to the extent to which the overpowering spell of the superstition of the First Urbanization was questioned or removed. In other words, it meant depopulating nature of the goddesses and gods along with denuding the supreme authority of their earthly representatives. But that would have amounted to the collapse of the administrative infrastructure of the first cities.

This enables us to understand why Gordon Childe mentioned only arithmetic, geometry and astronomy while illustrating the making of exact and predictive science as a trait of the urban revolution. There was really no scope in it for steps to be taken to rational natural science. That must have demanded doubt of the age-old religious beliefs—a thorough or even a revolutionary change in the general intellectual climate of the country. This, in its turn, could result from a fundamental change in the administrative machinery.

Such a change took place long after the end of the First Urbanization. In the history of the Indian subcontinent we find it taking full shape in the period of the Second Urbanization. It was during this period that we find rational natural science—along with its characteristic methodology—coming into being with remarkable possibilities. Historically speaking, therefore, before passing on to the question of the first formation of rational natural science, it is necessary for us to have a few words on what happened after the decline of our First Urbanization and more particularly about the new turn of events foreshadowing the Second Urbanization with its changed intellectual climate.

5. AFTER THE END OF THE FIRST URBANIZATION

Depending mainly on radio-carbon dating the archaeologists are on the whole agreed that the imposing cities of the Indus Valley civilization came to their end sometime near the middle of the second millennium B.C. But during a considerable period preceding it, the civilization was already under the grip of a creeping paralysis. This was perhaps only to be expected : when the main prop of the administrative infrastructure of a civilization is sanctified superstition, all innovations in technique as well as thought are frowned upon, leaving the civilization to stagnate and degenerate.

As for its end—or, more properly, that of its major cities—we are confronted literally with a mass of conjectures and counter-conjectures among the archaeologists, notwithstanding the tall claim of some of them that they are concerned only with cold material evidences unearthed. Therefore, much that one would like to hear about what actually happened to the Harappan peoples—from the humble craftsmen whose labour went to the making of the imposing cities to the priests or their corporations organizing this labour power—the question about them remains at present only a pointer to further research, it being *prima facie* absurd to imagine that the entire people once inhabiting a vast area and having a highly sophisticated civilization as its epicentre became totally extinct after the ruin of its major cities. Even the very question of any possible survival of the Indus Valley civilization in the later period remains a strongly controversial one. S.R. Rao, in his *Excavations at Rangpur and other explorations in Gujarat* (1963), wanted enthusiastically to prove many a survival of this nature, while A. Ghosh, in his *City in Early Historical India* (1973) was no less enthusiastic to tear such a hypothesis to pieces.

One is thus obliged to leave the professional archaeologists to settle their accounts among themselves and remain satisfied with a point on which at least the majority of serious archaeologists appear on the whole to be agreed. From the technological viewpoint at any rate, the end of the Indus Valley civilization was followed by a fallow period stretching over a thousand years or more.

It was, as A. Ghosh aptly described, a period of reverting to the preliterate peasant communities.

Then, round about 600 B.C., the history of the Indian subcontinent started taking a perceptibly new turn. It was a turn to the building of city life again, though its *main* scene now shifted to the Ganga valley, and, as we shall see, with a different political-administrative infrastructure. This was the turn to the Second Urbanization.

The date 600 B.C. just mentioned is more than merely conventional, for it is based on some clearly discernible factors. But there is scope to presume that even such factors could not themselves be just abrupt occurrences ; these were likely to have been the final result of the accumulation of slow changes that were going on under the surface and still awaiting our better understanding. In other words, the move towards the Second Urbanization was presumably a protracted process and the causes accounting for it highly complex.

The archaeologists in India and Pakistan are still digging to come to a fuller understanding of all these, though the prevailing communication gap between them due to present political tension is a matter of much regret. In any case, what we learn from archaeology mainly of the Ganga valley for the period intervening the end of the First and the beginnings of the Second Urbanization remains somewhat scattered, fragmentary and even controversial. It is thus premature to expect a full understanding of the period preceding the one from which the historians take over the story of ancient India.

6. MILITARY TECHNOLOGY

In default of archaeological data neither adequate nor yet satisfactorily systematized, our historians are naturally inclined to turn to literary sources, though with the oft-repeated caution against any uncritical use of them, using archaeological materials in so far as these are available. But the problem of the formation of the Second Urbanization comes under the scope of those who specialise in ancient Indian history. We have therefore considered it expedient to leave the subject to be surveyed by a trained historian. Fortunately our young friend Ranabir Chakrabarti has responded to our request. His invited contribution is to be found in the present work as forming its *Appendix I*. We shall concentrate here mainly on that aspect of it which concerns our basic theme. But it may be useful to redefine the exact purpose—and hence also the scope—of our own discussion. Our purpose is not at all to attempt any sketch of the general history of our ancient period. It is, on the contrary, very specific, namely, to have some idea of the general historical setting in which early steps could be taken to rational natural science. No such step, we have argued, was possible in the period of the First Urbanization and this for the simple reason that the ideological prerequisite essential for the urban revolution precluded its possibility. Rational natural science, along with its characteristic methodology, was however an accomplished fact in the Second Urbanization. We shall see how brilliant had been its early promise.

Admitting this, the presumption is that the ideological setting inhibiting the possibility of the making of rational natural science in the First Urbanization must have made room in the Second for a general ideological frame that could allow the tendency to understand nature without any alien addition. The presumption, in short, is that there must have been some fundamental change in the theoretical climate of the new situation. But the theoretical climate in the First Urbanization was itself not an accident : it was required by and therefore rooted in the administrative infrastructure of the earliest cities. In fact, the first cities could hardly come into being without inhibiting human curiosity to remain under the strict surveillance of sanctified superstitions. Not that science is intended to be viewed here as a matter of mere curiosity. It is understood instead as closely connected with technology. Nevertheless, the point is that at least the major technological prerequisites for the making of rational science were already achieved towards the end of the neolithic age on the eve of the urban revolution. Yet rational natural science could not and did not develop in the earliest cities. Here, therefore, we have an instance of basically political-ideological factors interfering with the scientific activities, more instances of which we shall see later.

Since, rational natural science did come into being in the period of the Second Urbanization, we cannot but admit that the political-ideological inhibitions to it were removed—or at least considerably weakened—already on the eve of the event. In other words, there must have been some basic change in the administrative machinery that no longer needed the overpowering force of superstition for running the state. It must have made room for some power which, whatever be its actual nature, was predominantly secular.

What then, was new in the changed administrative set-up ?

Its main prop was military technology which pushed superstition to a secondary position—a position from which it could only help, and even justify and eulogize—the new class of rulers caring above all for military might. Not that no tension was created between the military power and the priestly one. Evidently, it must have taken many a century for the two to come into some working adjustment, which we read about in the *Artha-sastra* and more in the Dharma-sastras, and perhaps still earlier in the literature called the *Brahmana-s* and *Upanisad-s*. In the *Brahmana-s* this was formulated in terms of the magnificence of the "lordly power" working in close co-operation with the "holy power," the latter remaining, in the priestly version at any rate, materially dependent on the former. Utmost effort was made no doubt to justify this holy power as a spiritual auxiliary of supreme importance to the "lordly power", which, in plain language, was simply the raising of armed forces.

However, admitting the usually accepted date of the turn to the Second Urbanization as 600 B.C. and that of the *Brahmana*-literature placed earlier than this (though not more than a century or two), we have to accept that the beginnings of the change in the administrative set-up—the gradual growth of military technology in it—is to be traced to an earlier period, often called the later Vedic. This is virtually admitted by the priestly literature itself and somewhat dramatically corroborated by recent archaeological findings. Before passing on to this, it may be relevant to have some more idea specially of the consequences of the basic shift to military power as the main prop of the new administration.

Such a shift is not to be understood in its isolation. It carried on its heels a number of other factors. It required extensive detribalization, if for no other reason than recruitment for the army. It required a growing bureaucracy. Admitting that the strategy and tactics of the army could be left to the military commanders of different ranks, officials were needed to look after the treasury and stores without which the army—now basically mercenary—could not be maintained. It required deforestation for the extension of arable lands to ensure greater agricultural surplus to feed the soldiers, officials and presumably also the new class of wholetime specialist craftsmen to look after the fashioning of new kinds of arms and armours. Along with the new arable land was also needed improved agricultural technology—of ploughing, irrigating, sowing and enriching crop-patterns. Taming and training new animal species—particularly elephants about the use of which in war we first hear in the new period—was needed, though perhaps also for trade and other purposes. Improved agricultural technology apart, to meet the increasing demand of the royal coffer as also of royal luxury, ways of exploiting other natural resources of the country had to be explored as far as feasible. Mining and allied activities received a new impetus. This, in its turn, called for other brands of specialized craftsmen and technicians. As a result, new and newer products came into being, some for direct consumption, and others—gradually gaining in volume—assumed the form of marketable commodities. For the efficient handling of the commodities, the trading class—kept subdued before—started coming into prominence. In the centres of the Second Urbanization, we find the mercantile community amassing enormous wealth even after meeting the financial demands to fill the king's treasury by way of paying taxes, tributes and customs. Commodity production and trading eventually reached a stage where minted coins had to be improvised. In *Appendix II* of the present work may be found the technique of minting. We are indebted to B.N. Mukherji for this invited contribution.

So also had to be reintroduced new systems of writing. Though the earliest specimens of these we have were inscribed in the Asokan edicts, and hence intended above all to propagate the royal policy, their standardization is presumed to have presupposed a century or two and the initiative taken in the matter by the mercantile community, perhaps using for the purpose perishable materials, cannot outright be ruled out. As a matter of fact, already in the *Arthasastra* (ii. 7.1) mention is made of the need of maintaining written record-books (*nibandhapustaka*-s) as distinct from composing royal edicts (ii. 10).

New communication channels—both overland and riverine—had to be opened not only for the movement of troops for expansion of royal territories but also for that of traders' caravans. For trading, not remaining confined to inland one, ports had to be built and maritime technology improved. Forts and fortifications had to be constructed for obvious reasons ; townships and cities following their heels, though the latter often as enlarged trading centres. All this could not but provide architectural technology with significant stimulus. The financial power of the mercantile community, increasingly gaining, must have had considerable impact on the basic social fabric. But though we read of its protest against the exorbitant extortion by the royal power, we have no evidence of it assuming the real political power by way of overthrowing the royal one, notwithstanding all the tension between the two, along with the tension of royal power with the priestly one. In the political philosophy of the *Arthasastra*, the paramount political power remained vested in the king. Nevertheless, it may be permissible curiosity to search for some theme—implicit or otherwise—running through all these and as having some light to throw on the main question we are asking ourselves concerning the changed intellectual climate. We are going to show that, broadly speaking, this was the assertion of essentially secular power in the administrative infrastructure of the Second Urbanization, pushing the priestly power at best to the background.

CHAPTER 2

PRIESTS TESTIFY TO THEIR OWN POLITICAL RETREAT

1. PRELIMINARY REMARKS

We have before us a number of books in which some of our first-rate historians and also some eminent archaeologists have tried to work out the full story of the transition to the Second Urbanization. For our own purpose we shall specially concentrate here mainly on one aspect of this transition. Besides having immediate relevance for our discussion this aspect of ancient Indian history is least discussed by our scholars and even totally ignored by some.

The priestly literature itself, properly analysed, has enough indication to show that the priests themselves with all their arrogant claims for the highest status in social hierarchy virtually admitted that during the Second Urbanization they were being pushed to a secondary and in fact to a parasitical position, making room for the war-lords or military chiefs to come to the fore. As a result the inhibitory power of the priestly ideology for the making of rational natural science was considerably weakened, if not completely washed out. The assertion of secular power in society helped, in other words, the growth of a secular way of looking at things.

Lest there by any confusion, it needs at once to be clarified that by priestly literature we do not at all mean here any literary creation of the priests of the First Urbanization, oral or otherwise. Even imagining any such literature once having been in existence, we have to admit that, at the present stage of research at any rate, we have no knowledge of it whatsoever, despite all that has been written so far about the religion in the Indus Valley civilization by Marshall and others depending mainly on circumstantial evidence.

Still the fact is that during the period intervening between the final decline of the major Indus cities and the new turn of events in the Ganga valley, there came to special prominence a considerable number of priestly corporation, which claimed for themselves highest status, both social and political. Besides, a huge bulk of literature—evidently oral—was composed by these mainly on the theme of what they called *yajna*-s, meaning rituals or sacrifices, which were supposed to ensure the fulfilment of a veriety of desires.

Peculiarly enough, a later philosophical school called the Purva-mimamsa, which very strongly claimed to represent the viewpoint of the priest-class as such, asserted that *yajna*-s, by the inherent efficacy of their own, effected the fulfilment of desires. There was, in other words, no question of divine intervention and even of the very existence of divinity. The representatives of this philosophy went even to the extent of denying the very existence of the gods or of any supreme God and this for the purpose of making room for the absolute efficacy of the *yajna*-s. What is apparently strange about such a position is that the earliest and vast collection of the orally composed hymns and songs called the *Rgveda-samhita* which to these priests enjoyed scriptural sanctity, is apparently full of deities or *devata*-s—Agni, Indra, Mitra, Varuna and so on.

How then, did the Purva-mimamsa philosophers propose to settle their account with these ancient deities? They virtually argued that such deities were not real deities at all ; in substance these were but mere sounds appropriate only for the spells essential for the performance of the *yajna*-s.[1] Much therefore to the annoyance of Vedic orthodoxy tenaciously claiming continuity of these priestly corporations with the tradition of the *Rgveda-samhita*—the tenacity that led the most renowned commentator Sayana to claim that all the songs and hymns of the *Rgveda-samhita* were intended for being applied (*viniyoga*) to the *yajna*-s —the philosophers of the priestly corporations themselves indicated a break away from the early Vedic tradition.

The basic text of these priests having *yajna* as its exclusive theme is called the *Yajurveda-samhita*. According to later mythology, it was supposed to have once existed in a thousand different recensions, most of which—strangely enough—were said to have been destroyed by the Vedic god Indra. Could it be a way of admitting that the priests were not actually conforming to the earlier Vedic tradition? In any case, what come down to us are only a few of different recensions of the *Yajurveda*. The be-all and end-all of these is the *yajna*, or, more properly, different forms of *yajna* supposed to fulfil different desires. After the *Yajurveda* came into being another class of literature with the same theme. This was called the *Brahmana*-s. Composed in the most cumbrous prose, these are often enormous in bulk. Though the actual dates of the *Yajurveda* and the *Brahmana*-s can by no means be determined with real precision, lifelong Vedic scholars are reluctant to allow us to place these outside the time-range of roughly the eleventh/tenth to eighth/seventh century B.C.

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[1] The point is extensively discussed by K.A. Nilakantha Sastri in *Indian Antiquary*. Vol. 50 (1921), 211-40.

From all these at least one point appears to be clear. Roundabout the eleventh/tenth century B.C. we find a number of priestly corporations acquiring prominence. Wherefrom emerged those corporations is a question that seems yet to be fully settled. The orthodox view is of course there : these emerged from the Rgvedic tradition itself. In support of this, one can easily cite numerous occurrences of words which at least in later times meant the priests (*purohita*-s) or the different classes of priests looking after different aspects of the elaborate sacrificial rituals. These priests to whom were assigned the specialised jobs of looking after different aspects of the *yajna*, are referred to by different epithets like *rtvij*, *hotr* etc. But the meanings attached to such words from the *Yajurveda* onwards have apparently undergone some changes in significance. Granting such a possibility we have to admit that it is futile to try to see any continuity of the early Rgvedic tradition with the compratively later or the Yajurvedic one. If so, the question remains how and wherefrom emerged the priestly corporations from roughly eleventh/tenth century B.C.

F.E. Pargiter[2] conjectured that "the earliest brahmans were connected with the non-Aryan peoples" which "is corroborated by the close connexion that existed between them and the Daityas, Danavas and Asuras". The evidence on which he mainly depended are internal to the Vedic literature though supplemented by later mythologies. What needs however to be noted in this connection is that he was trying to build up this hypothesis before 1922, when the archaeological data about the ancient Indus

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[2] *Ancient Indian Historical Tradition*, first published 1922, reprint New Delhi, 1972, p. 306.

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Valley civilization were yet to be systematically understood. With the later systematization of these data, D.D. Kosambi[3] came out with the bold conjecture that most of the later priestly corporations represented the consolidation of the stragglers of the Indus priests, who somehow succeeded in their attempts to affiliate themselves to the Vedic tradition. Some of the main evidences on which Kosambi depended are :

> There is good reason to believe that the first brahmins were a result of interaction between the Aryan priesthood, and the ritually superior priesthood of the Indus culture. There are innumerable *gotras* in seven main divisions of the brahmins, each of which must marry outside its own *gotra*, which thus corresponds to the Latin gens.... Evidence for non-Aryan brahmins is that some of them are called sons of their mothers, by name : Dirghatamas, who came to grief at the hand of Traitana, is son of Mamata, a dasi, the father is variously Usij or Ucathya. Aryans by birth are, in the RV., sons of their fathers. So, the legend is comprehensible that the blinded Dirghatamas floated eastward down the river, to find honour among strange people, as Indus priests might have tried to do. The reproach 'son of a dasa woman' was levelled against other vedic seers. Two of the prominent *gotra* founders, Agastya and Vasistha were born from jars ; the jar represents the womb ; in the case of Vasistha at least, the womb of some pre-Aryan mother-goddess..... Other features of brahminism might also support the view of adoption from pre-Aryans. The goddess Usas had twenty-one secret names known only to her special priestly initiates..... The long, rigid process of study under a chosen *guru* in the uncultivated forest served—as explained before—to preserve the immutability of the sacred books. This isolation could have given no information about city life, techniques, history, if it had been the practice from the very beginning. It is difficult to imagine voluminous erudition, myth, tradition of the most complicated sort emerging from this process—unless the brahmins had initially some literate and therefore urban background, which seems totally absent for vedic Aryans. Only the non-Aryans were the principal vedic city-dwellers.

Not that Kosambi's hypothesis is later followed up by many a historian of ancient India though there are some to take the point seriously. For our own purpose here we have neither the scope nor the real need to try to settle this question, though, as we shall presently see, that *yajna* as originally understood could be quite different from its Yajurvedic version.

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3. D.D. Kosambi ISIH 96-98. The point is more elaborately argued in his article "On the Origin of the Brahmin Gotras" in *JBBRAS* xxvi (1950) 21-80.

The more important thing is that if we analyse the later concept of *yajna* itself, one point leaps before our eyes. In spite of the free use of hyperboles intended to inflate their self-importance, the priests performing it were in fact pushed at best to a subordinate position in the Second Urbanization. The real socio economic power is assumed in fact by the war-lords and earthty rulers on whom the priests were utterly dependent. Let us try to be clear about this point.

What exactly was presupposed by *yajna* from the *Yajurveda* onwards ?

First, the priests, of course : when the sacrifice was elaborate enough, a whole host of them looking after its different aspects.

Secondly, all sorts of materials required for the performance of the sacrifice, beginning with those with which to construct the proper shed to the cattle to be slaughtered and melted butter poured into the fire for being burnt on specially constructed altars.

Thirdly, the appropriate spells for every detailed aspect of the sacrificial rituals.

The list of all these can indeed be enlarged. But *yajna* itself will remain totally unexplained so long as we do not take note of another factor of overriding importance. It is the individual financing the sacrifice, technically called the *yajamana*. It is he that hires the priests, pays them the professional fees for performing the sacrifices and foots the bill for everything required for the rituals performed. Without him nothing about the *yajna* is at all conceivable—no priest, no spell, no material and implement, nothing. As a matter of fact, the priests themselves could have no ostensible means of livelihood without the professional fee received from such a financier. This must have made the very existence of the priest-class totally dependent on the *yajamana*. In fact a legend occurring in the *Upanisad* indicates that the alternative to the professional fee for the sacrifice performed was stark starvation.[4] It was no wonder, therefore, that the topic of sacrificial fee or *daksina* should have occupied very great importance throughout the *Yajurveda* and *Brahmana* literature, without hesitating to go to the extent of identifying the *daksina* with *yajna*.[5]

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[4] *Ch. Up.* i. 10f.

[5] SBE xii. 48 sq. Cf. SBE 1. s.v. *daksina.*

Two points remain to be clarified in this connection.

First, why did the individual patrons agree to spend often a lot for the performance of the sacrifice? The answer to this is quite simple. The priests did their best to make the financier believe that the entire benefit supposed to result from it was ensured for the financier himself. Thus though the priests and priests alone possessed the know-how of the *yajna* and were actually performing it, they themselves had no share in the net result, beyond of course what they themselves specified as their professional fee for the service rendered.

Secondly,—and this is most relevant for our present discussion—wherefrom could the financiers themselves obtain fund enough for financing the *yajna* which was often a very expensive proposition? This brings us to the main point of our discussion. The financier or *yajamana* was almost invariably conceived by the priestly texts as kings or one belonging to the royal class who amassed wealth by plunder or extortion from the direct producers usually with no need felt for justifying such plunder, though somewhat later, they chose to call it tax or tribute. The direct producers called the *sudra*-s, as well as the originally petty traders called *vaisya*-s supplementing their income from small-scale farming and cattle-raising, were absolutely at their mercy. One of the *Brahmana*-texts bluntly declared that the royal class was entitled to kill the former at will and plunder the latter in any way it pleased.[6] Such vandalism is conveivable only on the assumption of its military might, about which the priestly literature itself is quite outspoken.

To sum up this discussion: From the *Yajurveda* onwards, Vedic literature takes a sharp turn to an all-absorbing interest in sacrificial ritual or *yajna*. This literature inflated the glory of the priest-class as much as it perhaps could, because it alone could put into practice the technique of *yajna*. From the economic viewpoint, however, it was a class utterly dependent on the other class financing the sacrifice. We have nowhere any indication of the priests themselves weilding real political power or of their craft becoming the real plank of the administrative infrastructure.

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[6] *Ait. Br.* vii. 29.

2. ARCHAEOLOGICAL EVIDENCES

The rise of military technology above everything else from roughly eleventh/tenth century B.C.—the usually accepted date of the *Yajurveda*—appears to be corroborated by archaeological evidences. The evidences are related to the introduction of iron technology. We are profoundly grateful to N.R. Banerji for his contribution to the history of iron technology in ancient India which we have used in the present work as *Appendix III*.

Despite controversies on the question concerning how and wherefrom this technology was introduced, the archaeologists are on the whole agreed that we first come across it in northern India in a very appreciable form as associated with the pottery type known as P.G. Ware. The sites of this pottery also coincide with the geographical horizon of the settlements of the war-lords ennobled by the priests. Their epicentre was then called Kuru-Pancala, i.e., roughly the upper Gangetic basin. Internal evidences of the *Yajurveda* and *Brahmana*-s also indicate that these texts were composed in the Kuru-Pancala region. Apparently, it must have been comparatively easy to find in this region patrons rich enough to finance the sacrifices. Who, then, were such patrons and how did they amass wealth enough to spend for sacrifices intended for their benefit?

R.S. Sharma has already shown that these affluent persons—who were none but the kings and princes—presumably owed their political and financial power from the early use of iron which was restricted primarily to military purposes. It would be relevant for our discussion to quote him at some length.

> On the basis of the iron objects that have been discovered so far in the Panjab, Haryana, western U.P. and the adjoining areas of Rajasthan in the levels belonging to *c*. 1000-500 B.C. we cannot postulate their use in handicrafts and agriculture on any considerable scale. In this phase only arrowheads and spearheads supplemented by nails have been encountered; axes, hoes and sickles are rare, and ploughshares are almost absent..... The PGW-iron period was therefore primarily an age of iron weapons and not of iron tools. Since the Upper Gangetic basin does not have any rich iron mines, and since the evidence for the use of bellows seems to be doubtful, the number of artifacts was limited. Even by the middle of the first millennium B.C. iron could not be a metal of common use because of two major limitations. The rich sources of iron in south Bihar were unknown to the people of the upper Gangetic and Sutlej basins. People probably used the iron ores found in Mandi in Himachal

> Pradesh, Patiala in the Panjab, and the Kumaon hills in Uttar Pradesh... From the technological point of view the period *c*. 1000-600 B.C. was one of primitive iron..... It seems that even weapons were limited in number and probably lay in the sole possession of chiefs and princes.[7]

To this Sharma adds :

> The discovery of iron weapons in a fairly large area from about 1000 B.C. onwards in northern India coincides with numerous references to this metal in the later Vedic texts of about the same period.....
>
> We can speculate on the role of iron arrowheads and spearheads, found at half a dozen PGW sites, in the formation of larger communities. Iron weapons have been discovered in the kingdoms of the Kurus in the upper portion of the Ganga-Yamuna doab, of the Pancalas in the Bareilly, Budaun, Farrukhabad districts and the adjoining district of Rohilkhand and the central doab of the Matsyas in the (Virat region) Bharatpur, Jaipur and Alwar areas, and of the Madras in the Panjab. But whether any of them possessed more iron weapons than the other cannot be ascertained. *As the largest deposit of iron weapons discovered so far belongs to Atranjikhera in the Pancala area, it seems that these people enjoyed an edge over their contemporaries in this respect. The larger kingdom of the Kuru-Pancalas may have owed its formation to the use of iron weapons.* In addition to the horse and spoked-wheel chariots, they evidently used iron-tipped arrows and spears, which have been found in the PGW layers of the excavated sites located in the areas over which they ruled. The Kuru-Pancala kings therefore were militarily superior to the Rg Vedic kings and their capacity to extract occasional tributes from the Vedic and non-Vedic chiefs was greater.[8]

Do we have here the real clue to the material basis of the spiritual glory imputed to the Kuru-Pancalas in the priestly literature? The wealth amassed by the kings there by sheer military might was only likely to have drawn the professional priests to their region. "The names of the principal teachers in the *Satapatha* (*-brahmana*)", observes Eggeling, "mark them as belonging to the *Kuru-Pancalas*, and as in i. 7, 28 (of the text) preference is given to a certain sacrificial practice on the ground that it is the one obtaining among these peoples."[9] More important is the statement in the same text that the Rajasuya sacrifice, being the royal sacrifice *par excellence* and hence one of the costliest ones, was performed by the Kuru-Pancala kings (*Sat. Br.* V. 5.2.5.).

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7. R.S. Sharma MCSFAI 60.
8. *Ibid*. 71-72. Emphasis added.
9. SBE xii. intro. p. xliii.

Nor did the priestly texts hesitate to suggest in their own way what really was the source of the wealth of these kings. It was, in short, their regular campaign for plunder. As put in the *Taittiriya Brahmana*, "their princes march forth on raids in the dewy season and return in the hot season."[10]

To sum up : That the Second Urbanization had an administrative infrastructure in which military technology had supreme importance is attested to by a vast amount of literary sources culminating in the *Arthasastra*. The generally accepted date of the turn to the Second Urbanization is roughly 600 B.C. What we have been trying to argue is that though from *c*. 600 B.C. the process of reurbanization was accentuated, the formation of its main basis, namely military technology, was going on and gaining momentum from roughly 1000 B.C. The priestly literature from the *Yajurveda* and the *Brahmana*-s testify to this and this seems to be also corroborated by archaeological evidence.

We may now wind up our present argument with a few more words on *yajna* and *yajamana*—the sacrifice and its financier.

3. MORE ABOUT YAJNA AND YAJAMANA

Let us first take the word *yajamana*. It provides us with an interesting example of a principle of comparative philology according to which words change more slowly than the meanings attached to them. *Yajamana*, as all dictionaries tell us, means the financier of the sacrifice, who, to get the sacrificial ritual performed, engages hired priests and pays them their prescribed fee, called *daksina*. The priests are thus employed because the know-how of the sacrificial performances is their closely guarded secret and the financier engages them because the material benefits supposed to result from the performances go to the financier or *yajamana*, who himself takes no part in the performance of the *yajna* beyond perhaps occasional and purely formal appearance (with or without spouse).

This point requires to be specially noted : The benefits of the sacrifice go not to the performing priests but to the patron employing them. It is like employing professional cooks to prepare delicacies for the rich man's table—the delicacies not to be consumed by the cooks themselves but by the financier, his family and guests.

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[10] *Vedic Index* i. 165.

The analogy of the cook is deliberately chosen, because it is one of the typical ones by which the grammarians explain the use of a suffix added to a root intended to differentiate between an act performed by one for one's own benefit and act performed for the benefit of another. The suffix used for the former is technically called *atmanepada*, for the latter *parasmaipada*. Thus the root *pac* means 'to cook'. One cooking for one's own consumption would be *pacate*, i.e. by adding the *atmanepada* suffix to *pac*. But the word for one cooking for others would be *pacati*, i.e. by adding *parasmaipada* suffix to the same root.

With this rule of grammar in mind, let us return to the word *yajamana*. There is no difficulty about the root from which it is derived, i.e. *yaj*, signifying the act of performing a ritual. But the question is : in whose interest or for whose benefit is it being performed? If it is the interest of the priests themselves who actually perform it, the least that is expected from the grammatical viewpoint is the addition of an *atmanepada* suffix, namely *sanac*. Peculiarly, however, though this suffix is actually added to form the word *yajamana*, the word is intended to mean one taking practically no part in the real performance of the sacrificial act, beyond of course financing the whole thing, inclusive of the payment to the hired priests engaged for the purpose. But grammar demands that for conveying the intended sense the suffix should be *parasmaipada*. But that is not so.

Here, therefore, is an obvious anomaly. *Yajamana* literally can only mean an actual performer of a sacrificial act *for his own benefit*. But in fact it came to mean, as Monier-Williams has shown, 'the person paying the cost of a sacrifice, the institutor of a sacrifice, who, to perform it employs a priest or priests, who are often hereditary functionaries in a family'. Monier-Williams himself does not bother to note how such a meaning of the word flouts grammar. But he cannot help reading the meaning he gives. Beginning mainly with the *Yajurveda* and throughout the *Brahmana*-s, the word *yajamana* does mean simply the financier rather than the actual performer of the sacrifice.

There is thus a problem here. How is this anomaly to be resolved? There seems to be only one answer to it. *Yajamana* in all presumption must have once meant the actual performer of the sacrifice, though eventually it came to mean simply the patron paying hired priests to perform the sacrifice for the former's benefit. The old word remained, but its meaning changed.

Since the changed meaning became conspicuous from the *Yajurveda* onwards, we are naturally expected to move backward from it to the earlier parts of the Vedic literature—particularly the *Rgveda-samhita*—to see if there is really any indication of the original or literary meaning of the word. But there are serious difficulties in such an effort.

The *Rgveda* alone contains 1028 songs in a total of 10,552 verses. Their composition must have taken a very long period of time. For modern scholars, the inner chronology of the *Rgveda* is naturally a formidable problem, which they are still groping to solve. This much is certain that some of these songs and even verses are considerably older than the others. Any hasty generalization about the early Vedic people based on some stray Rgvedic evidence is thus liable to be fallacious.

The early songs of the *Rgveda*, which often surprise us by their primitive vigour and unihibited imagination, had for their main theme the almost complete obsession with the problems of physical survival. These expressed endlessly as it were the desire for food, cattle, progeny, victory, and so on. All this was mixed up with the mythological imagination of a people, who saw deities in things they did not understand and which therefore filled them with awe easily passing into reverence—in the natural phenomena like the sun and wind, fire and forest, in the extraordinary might of their war chiefs or heroes, in the intoxicating power of their drink *soma*, and so on. The deities were important for them because they were supposed to be aids to the fulfilment of elemental desires. As people with a rudimentary control over nature, the poets saw deities even in their frankly pathetic wish-fulfilment, like the prevention of abortion and the cure of phthisis.

People at such a rudimentary stage of development are hardly expected to live in a society in which there could be scope for any partron rich enough to stand over and above the community and employ paid priests to perform sacrifices supposed to enhance only his wealth and power. But since all the 10,552 verses in this compilation must have taken many a century to come into being, the time-gap between its earlier strata and later strata could not but be considerable. During this period, the entire fabric of the Vedic society must have considerably changed. There are in the *Rgveda* songs or hymns in "Praise of Gifts", which the later work *Brhaddevata* (vi. 45.92) called *danasuti*-s, freely using hyperboles to extol the virtues of *daksina* or the fee for the performing priests. No serious Vedic scholar would doubt the basic fact that such hymns were very late additions—as late perhaps as the formation of the *Yajurveda* and the *Brahmana*-s. In the same *Rgveda*, however, are to be found hymns belonging to a considerable antiquity, some even preserving the memory of a more distant past. Meeting the *yajamana* in its accepted later sense is of course only to be expected in the hymns like the *danastuti*-s. What is inconceivable, however, is the place of any rich financier of sacrifice standing over and above the community in the early hymns, though it is quite cenceivable that such hymns. throbbing with the spirit of the collective life, were aware of some magical rites, like those that are observed by the ethnologists among the primitive peoples still surviving in the tribal pockets.

Could it, then, be that the word *yajna*, as occurring in the earlier hymns of the *Rgveda* referred to something like that? It may not be out of place to mention here that the later priestly literature like the *Brahmana*-s harp on a peculiar point. These want us to believe in their own way that *yajna*, in its original form, was lost. What we have in the priestly literature is only a form of it later reconstructed from its fragmentary survivals and this understandably under the initiative of the priests, though, understandably again, with the aid of their royal patrons. This seems to form a persistent theme of the *Aitareya Brahmana* in particular. Howsoever tiresome the *Brahmana* passages may generally be, we shall have to bear at least with some of these (*Ait. Br.* vii. 19. Tr. Keith RVB 309-10):

> "Prajapati created the *yajna;* after the creation of the *yajna* the holy power (Brahma) and the lordly power (Ksatra) were created..... From them, the *yajna* departed ; it the holy power and the lordly power pursued ; the holy power pursued with the weapons of the holy power ; the lordly power with those of the lordly power. The weapons of the holy power are the weapons of the *yajna;* the weapons of the lordly power are the horse chariot, the corslet, the bow and arrow. The lordly power returned without attaining it ; from its weapons it turned away trembling. The holy power followed it and obtained it ; having obtained it, it kept blocking it from above ; it being obtained and blocked from above standing, recognising its own weapons, went up to the holy power. Therefore

even now the *yajna* finds support in the holy power and in the Brahmins. The lordly power then followed it ; it said, 'Do thou call upon me in this *yajna*'. 'Be it so', it replied, 'lay aside thine own weapons, and with the weapons of the holy power, the form of the holy power, becoming the holy power, do thou come to the *yajna*.' 'Be it so', (it said). Thus the lordly power..... having laid aside its own weapons, with the weapons of the holy power, went to the *yajna*. Therefore, now also the Ksatriya, as the *yajamana*, having laid aside his own weapons, with the weapons of the holy power, with the form of the holy power, becoming the holy power, goes to the *yajna*."

Notwithstanding the zeal of the priests to glorify themselves they could not afford to forget the basic fact that without the accumulated wealth of the 'lordly power'—of the ruling Ksatriya-s or kings—the performance of the *yajna* was not feasiable. Hence the *Aitareya Brahmana* (vii. 22. & Tr. Keith RVB 311) had to acknowledge in its own way that the roḷe of the kings was not so secondary after all :

"He who has recourse to the kingship has recourse to the lordly power, for the kingship is the lordly power. Him who has recourse to the lordly power the holy power does not oppress......"

But let us leave such weary passages of the *Brahmana* literature and turn to some simpler evidences concerning the prehistory of the *yajna* and *yajamana*. Bloomfield has observed, "There is always one *yajamana*, or bestower of the sacrifice ; the sacrifice rebounds to his benefit and that of his family."[11] What he does not note, however, is that in the *Rgveda* there are clear evidences of the use of the word in the plural—of the *yajamana*-s instead of a *yajamana*—and what is perhaps more important, the benefit resulting from the ritual performance is supposed to go to the collective body rather than to any individual or his family alone. Here is a crucial evidence from the *Rgveda* :

"We, the *yajamana*-s, with favourable *mantra*-s (spells) invoke you (*agni*), who are best of the laudable, the foremost of the Angirasas, the wise one, with blazing hair, going round like the sun, one who fulfils the desires of the people (*visah*) and of the *carsani*-s." (Rv i. 127.2).

There can be no doubt that the *yajamana*-s and the people were identical in this verse. Even Sayana—the most orthodox of the vedic commentators wanting to argue that the entire *Rgveda* consists only of spells for sacrificial rituals—had to admit this. He interpreted *visah* in this verse as the *yajamana-rupa-prajah*, "people in the form of *yajamana*-s". Equally interesting is his note on *carsani*-s : "of the men, i.e. of the *yajamana*-s, or of the *carsani*-s who previously being men later attained the status of the gods by dint of *yajna*-s, and thus became fit to invoke the gods". At least one point is clear : the *yajamana* was yet to be raised to the status of the financier or the individual patron paying for a sacrifice for his personal benefit.

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[11] Bloomfield in *JAOS* xix. 13.

Here are some more verses of the *Rgveda* in which the word *yajamana* occurs in the plural and, presumably, in the sense of the common people desiring material wealth :

> "O Agni, the *yajamana*-s daily hold towards you all the best wealth : along with you, desiring wealth, the intelligent people opened wide the stall full of cows." (x.45.11).
>
> "The gods and the *yajamana*-s, the protectors of the wind, ask for the goddess Sraddha (Reverence); calling her with intense longing, they gain wealth through Sraddha." (x. 151.4).
>
> "(O Indra), the wish-yielder, let not the *yajamana*-s other than us delight your two horses with smooth back ; always approach us bypassing them,—we shall satisfy you with filtered *soma*." (iii. 35.5).
>
> "O Indra, drink this food that intoxicates and releases these two moving horses of yours at this place ; let not the other *yajamana*-s delight you much ; hence these *soma*-s are for you alone." (x. 160.1).

More significant, however, are two other verses in which the *yajamana*-s were described as receiving shares (*bhagam*) of the tribal wealth and also as attending the council (*vidatha*).

> "Sarasvati, whom the fathers invoked and who, coming from the south, pervades the *yajna*—may she give to the *yajamana*-s the shares (*bhagam*) of the food, fostering wealth a thousand-fold." (x. 17.9).
>
> "O Agni, the possessor of food, the expert sons of Vasistha invoked you in the assemblies (*vidathesu*) with praises ; do give us, the *yajamana*-s, increasing wealth and protect us always with well-wishes." (x. 122.8).

All these occur in what is usually viewed as the latest stratum of the *Rgveda* and from this it may be legitimate to infer that the later sense of the word *yajamana* was not uniformly established even towards the close of the Rgvedic period. In these verses the *yajamana*-s were still the collective body of people whose desire for material wealth had formed the kernel of the early Vedic songs.

Of course, these Vedic songs, like the songs of primitive peoples all over the world, were associated with some ritual process. It may not be possible for us to reconstruct the exact picture of the ritual with which the songs of the *Rgveda* originally associated.

One point nevertheless is fairly obvious. The *Rgveda* contains many a relic of the older times in which there was no separation between the *yajamana* and hired priests, the performers of the rituals were themselves the *yajamana*-s. Thus :

> "The *yajamana* rules with the oblations (*saste yajamanah havirbhih*)." (i. 24.11).
>
> "(O Indra), you instruct the *yajamana*, the offerer of the oblation, in your great wealth (*yajamanaya siksasi sunvate bhuri te vasu*)." (i. 81.2).
>
> "(Indra) bestows beneficial strength to the *yajamana*, the offerer of the oblation." (i. 83.3).
>
> "To the *yajamana*, the performer of the good actions, the maker of the gifts and the offerer of oblations..." (i. 92.3).
>
> "O Pusan, follow the cows of ours, the *yajamana*-s, the offerers of the oblation, the singers of praises..." (vi. 54.6).
>
> "O Indra and Agni, listen to the call of the *yajamana*, the offerer of oblations." (vi. 60.15).

All this does not mean that throughout the *Rgveda*, the distinction between the *yajamana* and the hired priest remained absent. Being a collection after all of a vast number of verses composed over a very long period, the *Rgveda* retained, on the one hand, the relics of the primitive past, while on the other, it clearly foreshadowed the shape of things to come. Many a verse indicates the growing distinction between the *yajamana* and the priest in the later sense. We shall mention here only two interesting examples. "On the banks of the Asikni (Chenab) the *yajamana* is, at it were, the *hota* (*asiknyam yajamano na hota*)" (iv.17.15). *Hotr* was a class of later priests. The special interest of this verse, however, is in the use of the word *na*, 'as it were'. Evidently, this is an indication of the uneven development of the Vedic peoples. The living experience of the poet was that the *hotr* and the *yajamana* were separate persons and that is why he was wondering at the lack of this distinction among those who lived on the banks of the Asikni.

One result of this ultimate separation of the *yajamana* from the priest, i.e., of the development of a class of hired functionaries was that the *yajamana* was pushed aside as an outsider, so far as the process of *yajna* was concerned. As put in one of the latest additions to the *Rgveda* (*Valakhilya Sukta*-s : these were so late that Sayana considered them not worth commenting):

> "When the priests (*rtvij*-s) consciously shoulder the responsibility of the *yajna,* what can be the need of consciousness on the part of the *yajamana* ?" (viii. 58.1).

To sum up then : we have digressed long into the Vedic evidences in order to emphasize only one point. *Yajna* in its original form was ritual undertaken by the collective body of tribesmen rather than a single financier hiring paid priests for the purpose. In such a new set-up, the priest with all his self-glorification, virtually admits that he is reduced to some kind of a parasitical class, thriving on the patronage of those who have amassed money enough—evidently by plunder—to get the ritual performed for their benefit. The priests are thus no longer the ruling power, as they were in all probability so during the First Urbanization. Secular power, in short, was gaining supremacy already towards the eve of the Second Urbanization.

CHAPTER 3

NEW INTELLECTUAL CLIMATE : AN UPANASADIC OVERVIEW

1. PRELIMINARY REMARKS

If, because of the mandatory spell of superstition in the administrative infrastructure of the earliest cities, there could be "no place for a sceptic or a sectary" there, the Second Urbanization ushered in a whole host of them and created an intellectual turmoil in the country perhaps without any parallel. Out of this intellectual turmoil first emerged natural science with its characteristic methodology.

But let us not oversimplify matters. Let us not forget that the new intellectual climate also created new tensions and even new contradictions. It was not an era of unilateral progress towards the understanding of man and nature based on experience and reasoning. It was also an age of the consolidation of orthodoxy in new forms and with new dimensions, leaving later Indian culture the legacy of many a factor in which pseudo-science and even positively anti-science sought sanction. To mention only a few of these : It gave definite shape to the ideological justification in the form of the Law of *karma* and *adrsta* to the caste-structure of society in which manual workers and technicians practically in all forms were dumped under the contemptous category of the *sudra*-s, from whom the elite was best kept totally aloof. This deprived the elite of the direct experience of nature and made them turn to pure reason or pure meditation as the legitimate source of knowledge. As a result there came into being a world-view—or, more properly, a world-denying view—of the pure spirit or pure soul as exclusively real, and hence the mundane world at best a foolish phantom of imagination. Already on the eve of the Second Urbanization there was the tendency to extend a good deal of financial support and political patronage to this view which was even declared as having scriptural sanction. That could not but prove inimical to natural science, which, whatever may be its exact definition, can be nothing if not an attempt to understand and thereby master nature.

But all this forms only one side of the picture of the new intellectual climate we are discussing, which on considerations of expediency, may be referred to as the Vedic orthodoxy. But the point of decisive importance is that there was also another side of the coin. We meet all sorts of dissidents and non-conformists, some of whom went to the extent of founding new sects altogether while some others without formally flouting the general structure of the Vedic orthodoxy showed the earnest zeal for an objective understanding of man and nature, acting thereby as the real precursors of natural science. It remains for us to see how remarkable had been the results some of them reached, judged specially in the context of their time.

The primary sources on which we are going to depend for this discussion are : (a) the principal *Upanisad*-s (b) the Pali literature (inclusive of the *Jataka*-s) considered canonical by the earlier followers of the Buddha, and (c) the *Jaina-sutra*-s enjoying scriptural status among the followers of Mahavira.

Of these, the Vedic orthodoxy claims that the *Upanisad*-s are but the ending portions of the *Veda*-s and hence have scriptural authority. We shall later see the unfortunate consequences of the claim as already emphasized by scholars like Winternitz. For the present we have other points to note.

Since Buddhism and Jainism—with all the major differences between the two—are generally considered as but protests against the Vedic (specially Upanisadic) view, both are taken as the major non-conformist sects from the Vedic standpoint, just as the Vedic orthodoxy itself is subjected to sectarian animosity by the Buddhists and Jainas. It is true no doubt that the tension between these three represents a very prominent feature of the new intellectual climate ushered in by the Second Urbanization. It needs nevertheless to be noted that we are liable to have a very inadequate idea of this new intellectual atmosphere if we keep ourselves confined only to these. No less interesting for us is the fact that in this new age we come across non-conformists not only from the three major standpoints but also within their general structures. This is specially interesting in the case of the *Upanisad*-s. What is all the more important for our understanding of the beginnings of natural science in Indian history is that in all the three forms of literary sources we have mentioned—the *Upanisad*-s, the early Pali compositions of the Buddhists and the

Jaina-sutra-s composed in the Prakrta language—we come across thinkers wanting earnestly to explore newer and newer avenues for understanding the mystery of man and the universe. But such attempts were often despised and denigrated by the official spokesmen of the views eulogized in the sources mentioned.

2. A MOTLEY OF HERETICS

We may conveniently begin with a passage of the *Maitri Upanisad* which gives us a rather picturesque description of a motley of heretics from the standpoint of the text. Though Vedic scholars as eminent as Winternitz[1] proposed to place it much later than the major *Upanisad*-s like the *Chandogya* etc., the presumption seems to be that it embodies a tradition coming down from a much earlier period and hence the possibility of its referring back to the period of our discussion cannot be outright ruled out. The text itself professes to defend the view that the ultimate reality (*brahman* in Upanisadic terminology) is Pure Spirit or Pure Soul. For the non-conformists or heretics it uses the descriptive epithet "those destined to go to hell". What seems to be of special interest about this passage is that, already in the Upanisadic period, there seems to have been scant respect for the much boosted theory of Pure Soul, specially among the working people despised in the already well-formed legal literature. Apparently, the spirit of dissidence had spilled over from the circle of the elites to the common masses. We shall have to analyse the passage to see if there is any hint in it of at least a section of the dissidents wanting to take some step to natural science, faintly though. But the passage first.

> Now, then, the hindrances to knowledge, oh king :
>
> Verily, the source of the veil of delusion (*moha*) is the association of one worthy of heaven with those unworthy of heaven. So it is. As is said, in spite of a grove being there before them, they cling to a low shrub.
>
> —Now there are some that are continually hilarious, continually roving about, continually asking for alms, *continually living upon handicrafts* (*nityam silpopajivinah*).
>
> —And moreover, there are others who are going about the towns asking for alms, who perform sacrificial rituals for the unworthy, who are but *disciples of Sudra*-s *and who have knowledge of the sastra-s* (different

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[1] Winternitz HIL i.233n and more particularly, 238.

branches of study) *despite being Sudra*-s (*sudrasisyah, sudrah ca sastra-viḍvamsah*).

—And moreover, there are others who are rogues with matted hairs, dancers, menials, religious mendicants, actors (*cata-jata-nata-bhata-pravrajita-rangavatarinah*), drop-outs from the royal service, and the like.

—And moreover there are those claiming fees for curing (ailments caused by) *Yaksa*-s (evil spirits of some sort), *Raksasa*-s (ogres), *Bhuta*-s (ghosts), *Gana-pisaca*-s (a host of flesh-eating fiends), hobgobblin, serpents, influence of evil stars and the like.

—And moreover there are others deceiving people by way of wearing red robes, ear-rings and skulls (*Kapalinah*).

—And moreover there are others who love to propagate disbelief in the Vedas with make-believe and trick of arguments that are futile and observations (*drstanta*) that are really false.

—One must not associate with them. They are evidently cheats and unfit for heaven. Thus it is declared :

> By the trick of the doctrine denying the soul with false observations and perverse arguments (they) delude the people causing failure to differentiate between knowledge and ignorance. (vii.8)

Apparently the heterogeneous heretics referred to were causing serious trouble to the Upanisadic orthodoxy, or else the *Maitri Upanisad* would not have described them at such length. For us, however, the passage itself has varied interest.

None with knowledge of Indian languages can gloss over the expression *cata-jata-nata-bhata-pravrajita-rangavatarinah*—translated above as "rogues with matted hairs, dancers, menials, religious mendicants, actors." It cannot but be reminiscent of those still surviving in our ideological underworld with various names (but often referred to as the Sahajiya-s). Perhaps in default of any better descriptive epithet, S.B. Dasgupta has described them as representing "the obscure religious cults", which really speaking are folk-cults bearing different local names, but mostly comprising low-class people roving about and singing their own folk-songs usually accompanied by their own style of folk-dances. From the reference to them in the Upanisadic literature, we cannot but admit that such cults come down from the period of early Second Urbanization, about the exact date of which it is not possible to be precise. What particularly interests us is that, broadly speaking, such persist to have an ideology of their own forming the core of their songs. The ideology continues to be highly nonconformist and is cryptically called *dehatattva*, literally "the doctrine of the body", with at best a negative concern for the "soul" (hence they are called *nairatmavadin*-s in our text, i.e. those who deny the existence of the soul). The folk-philosophy represented by the "perpetually hilarious and perpetually roving about" (*nitya-pramudita, nitya-pravasita*) wants to view the body and the body alone to be the only reality—even going to the extent of claiming that this physical frame is the microcosm of the universe. As is summed up in one of their favourite dictum : Whatever exists in the universe exists in the body itself.

We can now see where exactly was the rub. Why in other words so much of contempt is expressed for them who were but utterly despicable people—singing, dancing, acting and living on alms. With their denial of the soul they were taking a view which, if not materialist proper, might have been precariously near to proto-materialism.

It is tempting to have here another observation. In this description of the non-conformists, we come across the Kapalin-s or Kapalika-s. This is the only occurence of the word in the entire corpus of the *Upanisad*-s. A Sanskritist as eminent as H.P. Sastri has drawn our attention to the fact that with all the horrors propagated about them they could have been closely connected with the stark materialists, known as the Lokayata-s. As he puts it, "But the *Brhaspati-sutra* [a late text] tells us that the Kapalika-s are an ancient sect, at least as ancient as the Lokayata-s, and as the Lokayata-s with their Materialist Philosophy made the beginning of the Science of Economics, so the Kapalika-s with what system of philosophy we do not know, made the beginning of the Science of Erotics. Brhaspati considers them as distinct sects, but Gunaratna identifies the Kapalika-s with the Lokayatika-s The influence of the Lokayatika-s and Kapalika-s is still strong in India. There is a sect and a numerous one too the followers of which believe that *deha* or the material human body is all that should be cared for, and their religious practices are concerned with the union of men and women and their success (*siddhi*) varies according to the duration of the union. They call themselves Vaisnava-s but they do not believe in Visnu or Krsna or his incarnations. They believe in *deha*. They have another name *Sahajiya*."[2] If we accept this, we cannot deny that the ideological underworld of the roving non-conformists does have a hoary past.

[2] H.P. Sastri L 6.

But let us return to the other interesting points in the passage quoted. The list of contemptible non-confirmists in it includes "those who continually live on handicrafts." In the social norm of the law-makers which must have taken full shape already in the period of the *Maitri Upanisad* the crafts and craftsmen were strongly looked down upon and the contempt for them in our text is only to be expected. What needs to be added, however, is that the text is philosophical or proto-philosophical after all and the passage under consideration intends to describe those that did uphold *heretical views*. Could it, then, be that the despised craftsmen referred to had their own world-outlook or were at least accepting some, much to the distaste of the Upanisadic spokesman? The *Upanisad* itself does not provide us with any definite answer, or even a clue thereto, though, from the viewpoint of the history of science it may not be irrelevant to recall here an observation of P.C. Ray. He wanted us to see in the contempt for the crafts and craftsmen in the caste-based society by far the most important reason for the decline of the scientific spirit in India.[3] Admitting this, we have further to accept that the forces inhibiting the growth of science in India came into being already in a considerably ancient period, just as there were presumably also protests against these inasmuch as the craftsmen were also pressing for the assertion of their own views, annoying thereby the philosophers championing the view of the Pure Spirit as the exclusive reality.

From the sociological viewpoint the more important admission of the passage under consideration is that with all the strictures against the Sudra-s—who according to the law-makers were entitled only to serve the upper castes and hence denied of all opportunities of education—refused evidently to remain so obliging. Thus the author of the passage is annoyed not only by those that preferred to remain as disciples of the Sudra-s but also by others who, in spite of being Sudra-s, had mastery of the *sastra*-s. What then, could the word *sastra*-s mean here? The word generally stood for the scriptural lore, which, in the *Upanisad*-s meant specifically the Vedic lore. But it is not easy to think that any section of the Sudra-s could have cared much to master specially the Vedic lore during the time of the *Maitri Upanisad*, when the

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3. P.C. Ray HHC i. 192-97.

most intense contempt for the Sudra-s formed a conspicuous part of the Vedic lore itself. But the word *sastra* is somewhat flexible and it could also stand for any systematic body of knowledge, viz. Arthasastra, Kamasastra etc. Thus the expression those "who had knowledge of the *sastra*-s despite being Sudra-s" does not necessarily mean that a section of the Sudra-s were then cultivating the Vedic lore ; it could as well mean that despite all strictures against their educational facilities, at least a section of them was cultivating one or the other branch of knowledge considered desirable by it. But it is impermissible for us to conjecture from the text itself what such "branch of knowledge" actually could be, beyond the obvious suggestion that whatever that might have been, it was considered highly undesirable from the viewpoint of Vedic orthodoxy.

But let us return to the passage as a whole. Two points about it appear to have peculiar interest for us.

First, it describes the heretics no doubt, but not heretics of any particular brand. The text itself makes it clear that it describes a veritable motley of them—heretics of different brands with distinctive peculiarities of each. What deserves to be specially noted is that at least the majority of them were outside the circle of the "elite" of the period. There were dancers and singers, actors and roving alms-seekers, craftsmen and Sudra-s and even practitioners of folk medicine earning livelihood from curing diseases then considered as caused mainly by evil spirits etc. and, of course, snake-bites. Such therapists are not extinct from India even today, particularly among the backward villagers. In other words, the motley of heretics described did not exclude the working masses and their folk medicine. The significance of all this seems to be that it gives us some idea of how widespread had been the intellectual turmoil of the age ; even a broad spectrum of working people was involved in it—the text giving us a few samples of them. If, therefore, we have to trust the *Maitri Upanisad*, against which there is really no serious ground, we cannot but admit that the intellectual upheaval ushered in by the Second Urbanization must have been profound and widespread, even going down to the grassroots.

Secondly, the main drift of the passage needs also to be noted. Why was the text so much annoyed with the non-conformists or heretics as to go into a rather longish description of them? The text itself leaves us with no uncertainty about it. The heretics had not even a scanty enthusiasm for the admission of the soul. But this point is in need of some clarification.

For all that we know of the early Buddhists, it is generally admitted that they too denied the soul as a substance specially in the Upanisadic sense. Could it, then, be that the *Maitri Upanisad*, which being one of the latest of the principal *Upanisad*-s must have been post-Buddha, was referring to the Buddhist view of the denial of the soul, generally called *anatma-vada*? The decisive ground against such a possibility is that there is really nothing about the heretics described in the text—no word, no phrase, no epithet—that can be construed to refer to the Buddhists at all. With the consolidation of Vedic orthodoxy there grew various disparaging epithets for referring to the Buddhists no doubt. But the passage under consideration is completely unaware of any of these. On the contrary, what we have in the passage quoted is an indisputable description of all sorts of heretics coming from different social strata and apparently often with sectarian affiliation of their own. If all these did converge on the denial of the soul, as the passage does suggest, the corollary is that there were many ways or many approaches leading to its denial.

It seems to be of special interest to note here that at least a section of these heretics were not just denying the soul dogmatically. On the contrary, there are distinct hints in the passage quoted that they were using a definite method for the purpose, though understandably it was denounced as perverse.

What, then, was this method? The text mentioned it in its own way. Nevertheless, from the cryptic way of referring to it, we are left to infer that its essence consisted of observation of facts (*drstanta*) and reasoning or generalizing (*hetu*) based on it.

From the viewpoint of the history of science in India, the significance of this is not to be under-rated. With all that was later added to the elegence and certainty of basically the same method in somewhat later texts like the *Caraka-samhita* and *Nyaya-sutra*, this procedure of *generalization based upon observation* did constitute the crux of the scientific method that developed in India. The problem of dating the ancient literary sources remains, of course, a formidable one and it is impossible to be precise about the dates of the original core of the texts like the *Caraka-samhita* and *Nyaya-sutra*, and, for that matter, also of the *Maitri Upa-*

nisad. It is thus no use conjecturing concerning their chronological priority. Still, there is one point that cannot be evaded.

Serious Vedic scholars[4] have repeatedly shown why any monolithic idea of the Upanisadic view is bound to be fallacious. It was only the later Vedic orthodoxy which, by way of declaring the *Upanisad*-s as but revelations, wanted its best to rationalize the position that all thinkers of the *Upanisad*-s expressed an identical view. The prejudice created by this even for modern thinkers often proves a formidable difficulty for an objective understanding of the richness and variety of the views embodied in the *Upanisad-s* or of the various ways in which thinkers of the age wanted to explore the avenues to understand the mystery of man and nature.

From the viewpoint of our understanding of science in Indian history, by far the greatest calamity resulting from this prejudice is overlooking the real contribution of a remarkable thinker called Uddalaka Aruni, whose long discourse we read in the *Chandogya Upanisad.* We shall presently try to show how, notwithstanding all the later attempts to distort his actual position in order to make it fit with the much boosted extreme idealism of a section of the Upanisadic thinkers, identifying the ultimate reality with pure spirit, Uddalaka Aruni did in fact boldly knock at the gates of natural science to be opened. This made him the first rational natural scientist in the history of the Indian subcontinent, if not in global history. How far the non-conformists inclusive of the working people of this period contributed to the preparation of the soil of Uddalaka's science may not be an irrelevant question altogether. But more of this later.

3. VARIOUS QUESTS FOR THEORETICAL FUNDAMENTALS

Let us turn to another *Upanisad* called the *Svetasvatara.* There is, of course, something peculiar about this name which literally means "the white mule". Within the text itself its author-compiler refers to himself by the same name. But whatever interest the peculiarity of the name may have for others, the text itself has some positive significance for our own discussion. Though it wants to defend some form of early monotheism, it begins with the enumeration of a number of possible alternatives, though understandably for the purpose of rejecting them. Notwithstanding the circumstance that the text itself gives us no more than an enumeration of these alternatives—and this too as but bare speculations—from other sources we have the impression that at least some of the views mentioned in the list did contribute to the theoretical foundation of rational natural science that eventually came into being. It may therefore not be wrong to think that the *Svetasvatara Upanisad* opened with the enumeration of alternatives to the monotheistic approach inclusive of some that carried the promise of rational natural science.

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[4] Like G. Thibaut, R.G. Bhandarkar and many others whose view we shall later consider.

But the passage first. There are some linguistic peculiarities about it which makes its exact translation difficult and even somewhat controversial. Nevertheless, for the purpose of a general understanding, we may take the following as its plausible rendering, bearing in mind that the word for the ultimate reality generally in vogue in the *Upanisad*-s is *brahman* :

> "The theoreticians 'professing knowledge of the ultimate reality' (*brahma-vadin*-s) discussed among themselves :
>
> "—What sort of a cause is *brahman* ? Wherefrom do we come into being ? Whereby do we live ? And on which are we established ? Ordained by what, in pain and pleasure, do we have our various conditions ? Oh, ye, theoreticians of reality (*brahma-vadin*-s)?
>
> —"(Following are the answers suggested :) Time (*kala*), Natural law (*svabhava*, literally 'nature'), Fate (*niyati*, understood by some as 'necessity'), Chance (*yadrccha* or just fortuitousness, i.e. denial of cause as such), matter in its multiple forms (*bhutani*), the Primeval Man (*purusa*) —such are viewed as the ultimate cause [*yoni*, lit. womb] (in different circles of thinkers).
>
> —"Not a combination of these because of the existence of the soul (*atman*), and the soul certainly is impotent over the cause of pleasure and pain (implying that God alone rules over there)". (Sv. i. 1-2)

A somewhat similar passage enumerating some basic views then current is to be found also in the *Susruta-samhita* (Sarira sthanam i. 15). In this list occur the following views : (1) *svabhava*, (2) *isvara*, (3) *kala*, (4) *yadrccha*, (5) *niyati*, and (6) *parinama of prakrti*. It may not be wrong to conjecture that what is referred to as the Theory of Yoni in the *Svetasvatara Upanisad* is more explicitly mentioned in the *Susruta-samhita* as the Samkhya view of *prakrti* undergoing *parinama*, though we have taken the word to mean 'the ultimate cause' which seems to be more appropriate.

In another similar passage in the *Brhat Samhita* i. 7, mainly five theories explaining the origin of everything are mentioned, viz. (1) *pradhana*, (2) *dravyadi*, (3) *kala*, (4) *svabhava*, and (5) *karma*. It may be added further that neither the medical compilation nor the *Brhat Samhita* agrees to take much interest in such philosophical speculations. The former bluntly declares that notwithstanding controversies over these among the philosophers what medical science is exclusively interested in is the theory of matter : *bhutebhyo hi param yasman nasti cinta cikitsite* (Sarirasthanam, i. 17), while the *Brhat samhita* states : Enough of such discussions : What concerns the treatise itself are mainly three branches of Jyotihsastra as it understands (i.9). In both the enumerations, however, we have explicit reference to the Samkhya view of *prakrti* or *pradhana* being the ultimate cause—a point on which our understanding of the *Svetasvatara* passage differs. But there is no compelling reason to think that all the three texts under reference gives an identical list of the prominent views current in ancient India, beyond the obvious suggestion that the number of these was not insignificant. The intellectual turmoil of the Second Urbanization must have been considerable though the prominent views pressing for recognition might not have been recalled in identical forms in the comparatively later texts.

Our primary purpose of quoting the *Svetasvatara* passage is to illustrate the intellectual ferment of the Second Urbanization in the ancient Indian subcontinent. At the same time, since this passage gives us an unmistakable impression of the crystallization of a number of approaches to the understanding of the fundamental cause of the world, we cannot avoid here the further question : which of these fundamental tendencies helped the germs of later natural science and which, on the other hand, injured these ? As the ultimate cause the following alternatives have been suggested :

1. Time (*kala*).
2. Nature or perhaps "natural law" (*svabhava*).
3. Fate or perhaps necessity (*niyati*).
4. Sheer accident or fortuitousness (*yadrccha*).

5. Matter in its manifold forms (*bhutani*).
6. Primeval Man (*purusa*).

Before proceeding to the discussion of some of the important views referred to in this passage, a few words may be useful about our basic understanding of the passage itself. The second half of the first line under discussion reads :

bhutani yonih purusa iti cintyam.

The difficulty crops up with the use of the word *yoni* which literally means the female generative organ. A number of interpreters are inclined to see in this a reference to the Samkhya view of *prakrti* or its prototype, the reason being that *prakrti* in Samkhya is considered essentially as a female principle. Such an understanding, however, has appeared to us as somewhat far-fetched. Our feeling, on the contrary, is that we have perhaps a more coherent understanding of the entire passage if the word *yoni* is taken in the sense of the 'cause'—that 'which gives birth to'. From this point of view the word requires to be connected with the different alternatives suggested as Time (*kala*), etc. Accepting such an interpretation we have a reference here to six possible anti-theistic views concerning the ultimate cause of the world, which we have enumerated above.

Much that we may expect our text to tell us something more about these divergent approaches to the question of the ultimate cause, the fact remains that the *Upanisad* itself does not go beyond the bare declaration that these—or even these in their totality—fail to explain the basic facts of pleasure and pain experienced by the Self, which can possibly be ordained only by the Lord God.

In any case, for our present purpose of illustrating the new intellectual atmosphere of the age this brief passage is of exceeding importance, inasmuch as it gives us some idea of how many alternative avenues were sought to be explored already in the Upanisadic age for the purpose of understanding the ultimate reality. Some of the modern scholars have, therefore, proposed to recover from other sources more of these views.

We shall here discuss specially two of these, viz. *kala* and *svabhava*, leaving the doctrine of matter (*bhutani*) to be taken up later in connection with rationalist medicine.

CHAPTER 4

THEORY OF TIME (*kala-vada*)

Frauwallner[1] observes, "In the mythological and the religious sphere there is the idea of Time as the world-ruling power which brings forth everything and again destroys it—immensely impressive and capable of lasting development. To the philosophical thought, on the other hand, the idea of Time creates great difficulties. One begins, therefore, to discuss it comparatively late and the problems connected with it give rise to protracted and toilsome discussions. Thus it is to be understood that in the Iranian neighbouring region where the religious streams predominated, the idea of Time gained overwhelming importance and found its embodiment in the form of the God Zurvan who was long considered as the highest Godhead. In India, on the other hand, where in the attempts to explain the world, philosophy assumed the lead, the things developed differently."

There is much in this observation that is of obvious importance. But there also remains a number of points to be added. The fact is that the attempt to understand *kala* or Time from all sorts of viewpoints permeates a very wide range of ancient Indian literature, though not always with the zest of viewing it as the ultimate reality, often peculiarly shorn of any mythological or religious association and contributing directly or indirectly to the requirements of all sorts of subjects, inclusive of proto-science, pseudo-science, natural science, philosophy and jurisprudence.

Readers interested in all these may profitably turn to Chapters XIV-XIX of volume V, Part I (pp. 463-718) of the monumental work *History of Dharmasastra* by P.V. Kane, about whose encyclopaedic erudition no comment is at all necessary. Starting from the rather well-known hymns of the *Atharvaveda* (xix. 53. 1-10 & xix. 54. 1-5), he passes on to the *Brahmana*-s, *Upanisad*-s, the great epics (particularly the *Mahabharata*), the grammatical literature (Panini and his commentators), the philosophical treatises of the different systems (particularly Samkhya, Vaisesika, Nyaya and Yoga, although unfortunately leaving by and large unfulfilled the natural curiosity of the readers about the interesting speculations about Time in different Buddhist schools, which according to his understanding amount to the denial of the reality of Time !), the vast mythological literature (*Purana*-s) often found to digress at length on fundamental theoretical problems, and then passes on to the vast literature of the astronomers and astrologers, specially their tendency to discuss the units of time calculated in terms of the motions of the heavenly bodies and connecting all these with calendrical science as well as the pseudo-science of prognostication. In fact, over two hundred pages of Kane's learned discussion of the Indian views of Time are occupied by his survey of astronomical-astrological literature, digressing sometimes to the criticism of many a western scholar on various points.

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[1] Frauwallner ii. 75.

Not that the scope of our present discussion allows even any attempt to sum up P.V. Kane's erudite survey of the views of Time in all sorts of treatises he takes note of. But there seems to be one point of material significance that we cannot overlook here. That the astronomers and astrologers should be most keenly interested in the phenomenon called Time and devise methods of calculating it is, of course, easily understood : the shifting positions of the heavenly bodies as observed is the focal point of their interest and this can be comprehended only in terms of Time. The main drift of Kane's discussion of the Indian views of Time is thus not difficult to understand.

This cannot but be reminiscent of the observation of another extraordinarily erudite Sanskritist of our time, namely Gopinath Kaviraj. In a paper intended mainly to be a commentary on the opening passage of the *Svetasvatara Upanisad* enumerating so many anti-theistic views, he naturally raises the question of the *kala-vada* or Doctrine of Time. Since the text itself mentions only the view without telling us who were its actual exponents, Gopinath Kaviraj obviously feels the need of clarifying the point. And he observes, "The original Kala-vada was doubtless a fatalistic creed, much like the notion to which Uddyotakara refers in the *Nyaya Vartika* (Benaras Edition p. 459). But the doctrine of which Dallana speaks is evidently different. The writer quotes a verse from the astronomer Sripati, in which Time is described as the Lord-Isvara—the Source of world's efficient Causation. From the above as well as from the statements of Ramatirtha and

Agnicit Purusottama (commentary on *Samksepa Sariraka* I. 528) it would seem that this view was that of the astronomers."[2] Not that Sripati was a major astronomer of the country. This much is known however that he belonged to the eleventh century A.D.[3] Therefore, admitting the authenticity of the reference to Sripati, we have to admit that in some quarter of the astronomers at any rate the view that *kala* or Time was the ultimate reality—in fact as much real as the God ordinarily conceived—did persist as late as the eleventh century.

Be that as it may, we feel like drawing the attention of the readers to one point that seems to have eluded even scholars as great as P.V. Kane and Gopinath Kaviraj. It is the definite evidence we have in the *Caraka-samhita*, the earliest compilation on rationalist medicine that comes down to us, that such a view of Time did have an important place in the medical science of ancient India. We begin with a brief idea of the evidence itself and then pass on to see its possible relevance for medicine.

We shall later have the occasion to discuss this text in some detail and shall see that one of its prominent features had been the frequent mention of seminars or colloquiums in which different authorities met and debated in defence of different views. In one of these described in the very first book of the compendium (Sutrasthana, chapter 25), we read of no less than a dozen of authorities debating over the most fundamental question concerning the origin of man and diseases. One of them, mentioned as "Kankayana, the physician from Balkh" suggested the theistic standpoint that God alone can be thus viewed. This was immediately challenged by another authority, Bhiksu Atreya, on the ground that it was preposterous to think of God as inflicting suffering on men by way of causing the diseases : that was imputing malevolence to one conceived essentially as benevolent. On the contrary, argued Bhiksu Atreya, the view to be accepted was: "Man originates from Time (*kala*) and man's diseases likewise originate from Time. The whole world is under the suzerainty of Time (*jagat kalavasam sarvam*) and Time is the cause everywhere." (i. 25. 24-25)

As was only to be expected in a debate, this view was not accepted by the other authorities. What nevertheless needs to be noted is that from the viewpoint of rationalist medicine, though not necessarily raised to the status of the ultimate reality, Time was recognised as at least one of the important causal factors both for diagonistic and therapeutic purposes. Pending its fuller discussion we may briefly note here a few points. Thus the discussion of the fundamental principles of medicine (Sutrasthana) the *Caraka-samhita* is found to return again and again to the question of Time.

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[2] G. Kaviraj in SBS ii. 109.

[3] See S.B. Dikshit 103.

Time, asserts the compendium, is of importance in the matter of prognosis (i.1.54), for the "combination of action with things" (eating or drinking, for example, of certain things) in a wrong time causes diseases. Practically the same point is repeated elsewhere (i.1.34 f.). For a successful physician, again, it is as necessary to have the right knowledge of the measure (dose of substance used as medicine) as that of the appropriate time for administering it (i.2.16-17). And so on.

But why should the right knowledge of time be so important from the medical viewpoint ? One answer to the question is suggested in a long chapter of the *Caraka-samhita* (i.6), discussing how Time enters into the very being both of the body-constituents as well as all sorts of substances used as diet or drug. The ancient physicians discuss this in terms of their understanding of the seasonal changes. It was part of the standard view of the six main seasons, classified under two categories as determined by the observed change in the position of the sunrise. Sunrise is observed as moving towards the north (*uttarayana* = summer solstice) or towards the south (*daksinayana*=winter solstice): three seasons from *sisira* (dewy) to *grisma* (summer) fall under the summer solstice while the other three fall under the winter solstice. These seasonal changes, the ancient physicians are inclined to believe, are determined by Time. What, however, is medically important is that this broad division of the year into the two solstices profoundly affects the changes not only in the body-constituents but also in the substances consumed as diet or drug. Their understanding, as it is generally ignored by modern scholars, may as well be quoted at some length :

> Now the year, it should be known, consists of six parts when divided according to the seasons. From among these, the three seasons from the dewy season to the summer represent the sun's northern

course and sun's period of absorption (*adana*) : while the three seasons from the rains to the winter represent the sun's southern course and the sun's period of liberation (*visarga*).

During the period of liberation, the prevailing winds are not marked by excessive dryness, it is otherwise with the period of absorption. During the former, the moon with unabated vigour aggrandises the earth by surcharging it with her cool radiations and nourishes it constantly, therefore the period of liberation is characterised by the predominance of the water-element. On the other hand, the period of absorption is characterised by the predominance of the fire-element.

In this manner, the sun, the wind and the moon, governed by time as well as by their inherent nature and orbits (*kala-svabhava-marga-parigrhita*), cause the periods, seasons, *rasa* (teste or organic sap : the medical literature uses the word in both senses), *dosa* (morbid body-elements) and physical strength. (1.6.4-5)

With this basic assumption, our text passes on to discuss what is to be done and what not to be done—what is to be prescribed as diet or drug and what to be avoided—during the different seasons. But all these are discussed from the viewpoint of rationalist medicine of ancient India to which we shall have to return in some detail later. For the present our point is simply this : *kala* or Time had an ontological status for the understanding of man and nature in the medical science.

Incidentally, it may be mentioned here that Frauwallner quotes from Buddhist and Jaina sources two passages as specimens of the persistence of *kala-vada* in later times, when, according to him, the question of the origin of man and nature is taken over by maturer Indian philosophers naturally pushing such archaic one as those of Time to the background. Thus[4] :

> 'The Time brings all creatures to ripeness, the Time again destroys all things. The Time keeps awake among the sleepy. It is hard to transgress Time.'
>
> 'Without the Time, not at all, not even a bean is cooked, even when a man has placed the pot on the Fire ; therefore, a man knows that it has occurred through Time.'

It remains for us to see if it is too much to guess in such passages the influence of the medical views, particularly when we remember that the technique of cooking was considered an essential accomplishment for the physicians.

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[4] Frauwallner ii. 76.

Overlooking the place of the theory of Time in the medical compilation, Frauwallner prefers on the whole to remain confined to the philosophical literature to discuss the further development of the doctrine. We may quote him at some length :

"First of all we can say that the idea of Time vanishes where the proper philosophical thought comes in ; it emerges only comparatively later. It was considered by the nature-philosophical schools ; it only emerges, as it appears then, when one attempts systematically to understand all factors of existence and was persuaded to discuss the question of Time. It came about in this way that one was compelled to put the question anew—what is to be understood by Time. The reply ran as follows : Time is a permanent, ubiquitous entity which brings forth everything, but which is not itself visible but is only inferred as cause from its effects. In spite of the bald, matter-of-fact formulation of thought, here the influence of the doctrine of Time as the prime ground of all things—the only one on which a man could lean—is obvious. But is Time really the cause of all things ? Does it produce everything ? The nature-philosophy of the Vaisesika in their atomistic-mechanistic world-picture had sufficiently proved the origin of all things so that there was no room for Time as the World-cause. But still there is a case in which the influence of Time is palpable. When in spring, the flowers bloom, when in autumn, the fruits ripen, it is the work of Time. But is it also right ? On more exact consideration, one must say that it is not the things which Time brings forth. On the contrary, it only conditions the moment of its origin that they emerge in appearance earlier or later. So one came to the doctrine that Time causes the 'earlier' or 'later' of things.

"In the formulation of this doctrine we come across a remarkable thing. This 'earlier' and 'later' is referred only to the present, not to the past or future ; that is to say, of two simultaneous things, the older is to be understood as the earlier, the younger as the later. 'The earlier and the later are produced out of the earlier of the causes and the later of the causes'. The older is therefore, on that account, the earlier because it originated earlier, the younger, later because it originated later. But both are present at the same time. With it the questions about the past and the future and their character which have troubled the Buddhistic Schools so much are shoved away. Has it occurred intentionally ? Has the cause of it been put forth ? We are unable to say anything about it. According to the aim-conscious and consistent manner in which the Vaisesika have otherwise formulated their doctrine, one could like to believe it. But our sources are silent. The discussions regarding it must belong, according to a process of development, to a period which still lies before the formulation of preserved knowledge. The sources, which lie before us, know nothing to say about it."[5]

Frauwallner also considers it necessary to compare this doctrine with that of space which developed later as a part of nature-philosophy. As he observes :

"One thing need not be lost sight of. The doctrine of Time is perceptibly fashioned after the doctrine of Space. Finally, it was easy or proximate to lean upon the simple prototype of space while working out the difficult Time-problem. It, therefore, happens that in India the earlier and the later are expressed by the same words as the further and the nearer. So it is said : Just as far (*parah*) and near (*aparah*) express the relation of two things which lie in the same direction, so also earlier (*parah*) and the later (*aparah*) express the relation of two things which lie in the same scale of time. The 'earlier' and 'later' have also been always looked upon as the most important signs of time, in agreement with the doctrine of space. No doubt, in course of time, what otherwise expressed a time-relation—simultaneity and non-simultaneity, slowness and speed, was included. It is said : 'earlier, later, simultaneous and non-simultaneous, slow, quick are the signs of time'. But the idea of 'earlier' and 'later' have always remained the most important.

"A further point in which the doctrine of Time in the Vaisesika agrees with the doctrine of space is as follows : There is only one, single Time. When one speaks of the parts of Time such as moments, hours, days and years, it is only a metaphorical way of expression and serves a practical aim. Again one thing remains to be mentioned. A question with which Indian philosophy much occupied itself is the origin, duration and the disappearance or passing away as the constituents of things. Especially the Schools of the Buddhists and the Jaina have endeavoured to understand the nature of phenomena and have developed interesting thought-

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5. *Ibid*. 76-7.

processes in that connection. On the other hand, the Vaisesika teaches only that the rise, duration and disappearance of things are an effect of Time. This question has not been discussed exhaustively but they have chosen to make short ad hoc small comments in regard to the discussions of other systems.

"This is all what the classical Vaisesika system has to say on the question of Time. The essential thing about it is that the time is considered as a permanent, all-penetrating entity which is the cause of simultaneous things, of the one appearing earlier and the other later. We miss here the whole problem which other systems have developed in all its richness."[6]

Thus as evidenced by the Upanisadic literature, the doctrine of Time had originated in considerable antiquity. It contributed significantly to at least two branches of science, *viz.* rationalist medicine and astronomy. Eventually it was taken up by the Vaisesika philosophy considered as nature-philosophy in its most prominent form by thinkers like Frauwallner.

What Frauwallner completely ignores is another line of speculation that denudes time of any material reality (*vastusunyo 'pi ..... vastu-svarupa iva avabhasate*) and hence could have little or nothing to do with the development of natural science. We quote here from the Vyasa's commentary on *Yoga-sutra* (iii.51):

> As the Matter, reaching the limit of its diminution, is an atom, so the Time reaching the extreme limit of its diminution is a moment. Or, that much of Time by which an atom in motion gives up its previous position and reaches the next place, is the moment. The uninterruption of the flow thereof is however the succession. The moment and its succession have no aggregation as a substance, it is but an intellectual aggregation as the Muhurta (48 minutes), the day, the night, etc. It is in fact this Time which, although devoid of reality, becomes an intellectual creation following the literal idea. To ordinary persons with the exhibitive visions, it appears to be the real nature of the Substance.

Thus, the concept of Time, which had so much importance in astronomy, physics (Vaisesika) and rationalist medicine seems to lose relevance for a philosophy that had the withdrawal of interest from nature as its only ideal.

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[6] *Ibid.* 77-8.

CHAPTER 5

PROTOTYPE OF LAWS OF NATURE
(*Svabhava-vada*)

1. PRELIMINARY REMARKS

To avoid the impression of digression, we may briefly recapitulate the main purpose of the present chapter. It is to give some idea of the intellectual unrest ushered in by the Second Urbanization which had been a necessary precondition for the formation of the theoretical fundamentals of natural science in ancient India. Pending an account of this intellectual unrest as suggested by the Buddhist and Jaina sources we have begun with a brief sketch of it as preserved in the *Upanisad*-s. An interesting feature of the Upanisadic evidences is their suggestion that this intellectual unrest was not confined to the circle of the elites and was presumably wide enough to affect even the working people or at least a section of them. With a survey of it gleaned from the *Maitri Upanisad* we have passed on to a passage of the *Svetasvata* specially because it gives us some idea of the more prominent views then in circulation and considered as presenting notes of dissent. The sage Svetasvatara from whose name the title of the Upanisad comes down to us—whoever he might have been—wants us to believe that two of these had been most prominent, *viz*. the view of *kala* or Time and another referred to as *svabhava*. As the text puts it : "Some of the deluded sages call it (the world-cause) Time while some others call it *svabhava*" (*Sv. Up*. vi. 1).

What then was meant by *svabhava*? Did it have anything to contribute to the formation of the fundamentals of rational natural science? We are going to argue that the answer is in the affirmative, inasmuch as it presumably represented an idea of the prototype of what is later understood as the laws of nature.

2. SVABHAVA VS YADRCCHA

But such an interpretation will be seriously questioned by some scholars. There was a tendency in medieval India[1] to interpret

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[1] Santaraksita v. 106 ff ; for a somewhat similar tendency among the later Naiyayikas, see Phanibhusana iv. 150ff.

svabhava-vada as simply a denial of the causal law and some of the modern scholars follow suit.[2] However this is palpably unacceptable. In the history of Indian philosophy, the causal law was sought to be denied only in two ways, namely by denying the reality either of the effect or of the cause. The best known example of the first tendency was the extreme form of Indian idealism, the Advaita Vedanta. According to this, the cause alone was real and its apparent transformation in the form of the effect only an illusion. As for the second tendency, namely questioning the causal law by denying the reality of the cause itself, no major school of India philosophy is known to have subscribed to it. But the tendency itself must have been very old. It was mentioned in the list of the anti-theistic theories in the *Svetasvatara Upanisad* as the view according to which pure accident was the ultimate cause. This could only mean that there was no such thing as cause at all or that every event was absolutely fortuitous. The *Svetasvatara* itself referred to it as the doctrine of *yadrccha*, whereas some of the later writers preferred to call it the doctrine of *akasmikatva,* or sheer chance.

It is only by confusing this doctrine of chance with the doctrine of nature that one may be led to imagine that the latter also meant a denial of the cause and, therefore, of the casual law itself. One reason for this possible confusion could have been the atheistic implication of both the doctrines. Both denied God, the alleged efficient cause of the world. However, the two doctrines denied God from two opposite standpoints. These were the standpoints of pure scepticism and positive science. According to the doctrine of *yadrccha*, everything being fortuitous, it was futile to search for any cause of the world, either natural or supernatural. By contrast, the doctrine of nature claimed that though the supernatural cause was clearly illegitimate, the concept of the natural cause was not so. As a matter of fact, from this standpoint, the exclusive reality of natural causation was the ground for the total rejection of the possibility of any supernatural causation. There was no question of assuming God as the efficient cause of the world, because nature by its own inherent efficacy accounted for its origin and maintenance. The doctrine of *yadrccha* is usually translated as accidentalism. The right translation of the doctrine of *svabhava*, therefore, should be naturalism. The former viewed the concept of cause as a fiction, the latter considered the concept of the first cause over and above the natural laws as fictitious.

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[2] Vallee-Poussin in ERE viii. 494, G. Kaviraj in SBS ii. 94.

The author of the *Svetasvatara* clearly differentiated between naturalism and accidentalism, and some of the traditional Indian philosophers explained the points on which the two views really differed. Samkara[3] said, "By *svabhava* is meant the power invariably belonging to the material objects, as for instance [the radiation of] heat by fire······By *yadrccha* is meant purely fortuitous origin." Samkarananda[4] said, "By *svabhava* is meant the inherent nature of the respective material objects, i.e. their unique causal efficacy. For instance, burning in the case of fire and flowing downwards in the case of water······Chance (*yadrccha*) is a certain power that conveys in the manner of the crow and the palm-fruit [as in the fable of the fruit of the palm falling accidentally at the moment of the alighting of a crow]." [*kakataliya* : the typical Indian terminology of referring to accidental coincidence being mistakenly taken as causal connection, i.e., the fallacy of *post hoc ergo propter hoc*].

Amalananda Sarasvati[5] tried to emphasize the same fundamental difference between accidentalism and naturalism : "*yadrccha* means random occurrence without regard for the law of fixed causation, by contrast *svabhava* is that which exists as long as the thing exists, for example, respiration etc. [in the case of the living beings]." However, by far the clearest and most detailed exposition of the difference between naturalism and accidentalism is to be found in the writings of the Jaina philosopher Gunaratna.[6] It is necessary to quote him at some length :

> The naturalists (*svabhavavadinah*) claim as follows. By *svabhava* is meant the transformation of objects by themselves (i.e. because of their inherent nature). Everything that exists comes into being because of the operation of *svabhava*. Thus, for instance, earth is transformed into pot and not into cloth etc.........From the threads, again, is produced the cloth and not the pot, etc. Such regular occurrence cannot happen

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3. Samkara on *Sv. Up.* i. 2.
4. Samkarananda *Dipika* i. 2.
5. Amalananda Sarasvati *Kalpataru* ii. 133.
6. Gunaratna 13f.

without the operation of *svabhava*......Therefore, everything is to be finally viewed as due to *svabhava*. So it is said,

> 'Who makes the thorn sharp?
> And the beasts and birds so varied?
> All these come to being from *svabhava*.
> There is none whose desire forms them;
> what is the use of [postulating any supernatural] effort?'
>
> 'The thorns of the palm-tree are sharp,
> Some of these are straight, some others
> twisted. But its fruit is round.
> Tell us, who has shaped these?'

Let alone the cases of other effects, even the boiling of beans (*mudga*) cannot occur without *svabhava*. Moreover, in spite of the presence of the things like the cooking-pot, fuel, time, etc., the *kanka-duka-mudga* (probably stone chips resembling beans) cannot be boiled. Therefore, that in the absence of which something does not originate is related by 'agreement in presence' (*anvaya*) and 'agreement in absence' (*vyatireka*) to that something and hence that something is due to it. [In the presence of *svabhava*, something takes place; in the absence of *svabhava*, it does not take place. Hence, *svabhava* is the cause of it]. Thus the boiling of *mudga* is to be viewed as due to *svabhava*. Therefore, it is to be concluded that all these objects are caused by *svabhava*.

By contrast, the basic points of accidentalism were explained by Gunaratna as follows:

Chance (*yadrccha*) is the occurrence of an object without any previous scheme. Now, who are the champions of the doctrine of chance? Answer: Those who do not recognise any cause-effect relation of the objects as occurring in the series, but consider them as due to chance, are the champions of the doctrine of chance. They argue thus: There is no fixed cause-effect relation among the objects, because it (i.e. such a relation) is not apprehended by any instrument of valid knowledge. Thus, the lily (*saluka*) grows out of a lily, while it also grows out of cow-dung. Fire grows out of a fire as well as out of the flints. Smoke originates out of smoke and also out of the connection between fire and fuel. The plantain-tree grows out of the stem of a plantain-tree as well as out of the seed. The fig-trees etc. grow out of seeds as well as out of the twigs...... Therefore, there is nowhere any fixed cause-effect relation. It is to be understood that sometimes something originates due to chance. The wise, therefore, do not suffer in trying to find out the origin of things from anything else. As is said:

> All these various pleasures and pains of people appear suddenly, just as the connection of the crow with the palm (*kaka-taliya*) is not due to intelligence; hence the alleged knowledge

> [of causal relation] is futile. All these—birth, old age and death etc.—which we find among the people are [purely accidental occurrences] like the connection of the crow with the palm.

Thus, in spite of their common opposition to the view of supernatural causation, *yadrccha-vada* and *svabhava-vada* were themselves basically opposed to each other. Among the modern scholars, Hiriyanna[7] analyses this very clearly. He renders the two as 'accidentalism' and 'naturalism' respectively, and comments : "Both the doctrines are at one in rejecting the idea that nature reveals a divine power working behind it or indeed any transcendental being which controls it or is implicated in it. Nor does either school seek for its views any supernatural sanction." Nevertheless, the fundamental difference between the two must not be overlooked.

As Hiriyanna explains, "While the one maintains that the world is a chaos and ascribes whatever order is seen in it to mere chance, the other recognises that 'things are as their nature makes them'. While the former denies causation altogether, the latter acknowledges its universality, but only traces all changes to the thing itself to which they belong……Hence according to *svabhava-vada*, it is not a law-less world in which we live, only there is no external principle governing it. It is self-determined, not undetermined."[8]

Regarding *svabhava-vada* Hiriyanna further argues, "What needs to be noticed about it first is its positivistic character which is implied by the contrast that is sometimes drawn between it and the *adrsta-vada* or 'belief in the supernatural'. In this it differs from the supernaturalism of the Mantras and Brahmanas on the one hand, and, on the other from the metaphysical view of the Upanisads. The positivistic character of the teaching—its mundane metaphysics—seems to have been the original significance of the term *lokayata* ('restricted to the experienced world') more generally applied to the doctrine in later literature."[9]

To sum up : The *Svetasvatara Upanisad* preserves for us clear evidence of a number of atheistic standpoints that developed in

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[7] M. Hiriyanna OIP 103.

[8] *Ibid*. 104.

[9] *Ibid*. 103-4.

India at a considerably early period—presumably sometime near that of the Buddha. Of these, the doctrine of *svabhava* interests us most, inasmuch as we can see in it a distinct tendency to oppose the theistic assumption from the point of view of positive science, or at least of proto-science. In the clash between 'the doctrine of God' and 'the doctrine of nature', therefore, we have perhaps the earliest glimpse of the conflict between religion and science that took place in Indian history.

This leads us to raise another question. Who, among the Indian thinkers, preferred to subscribe to the doctrine of *svabhava*? This question is specially significant. We have shown elsewhere[10] that the overwhelming majority of the Indian philosophers were atheists, but their atheism was motivated by various considerations. As a result, Indian atheism was not always founded on the secure basis of the scientific outlook. In such circumstances, an affiliation to *svabhava-vada* on the part of an Indian philosopher would be at least one of the pointers to his scientific temper and, therefore, also of his atheism being science-motivated.

Who, then, were the naturalists in the history of Indian philosophy?

The *Svetasvatara Upanisad* itself does not give us any clue to this. It mentioned naturalism as a self-sufficient world-view as it were. References to the view in some of the Buddhist works like the *Buddhacarita*[11] and *Lankavatara-sutra*[12] give us practically the same impression. The *Mahabharata*[13] also mentioned the view repeatedly and, excepting perhaps once, without any clear indication of its affiliation to any well-known philosophical system. However, some of the *Mahabharata* passages appear to have an extremely interesting suggestion to add. The suggestion is that an ethics of complete detachment followed from this doctrine of *svabhava*.[14] Following this suggestion, it is tempting to go into some details of the possible ethical implications of ancient Indian naturalism for which, however, we do not unfortunately have the scope just now.

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[10] D. Chattopadhyaya *Indian Atheism*, 1980.

[11] Asvaghosa ix. 52.

[12] Ed. Kyoto, 1923, 184.

[13] Santiparvan chs. 179, 222, 224, 232 etc.

[14] *Ibid*. chs. 179, 222, 224. Could it be reminiscent of the position of Epicurus?

The later Indian philosophers were silent on the ethical attitude of the ancient naturalists, but some of them continued to show the tendency of treating naturalism irrespective of its affiliation to any specific philosophical system. Thus, for instance, the Buddhist Santaraksita[15] and the Jaina Gunaratna[16] wanted to refute naturalism as an independent philosophical position challenging the fundamentals of their own assumptions, though, peculiarly enough, both these philosophers found a similar challenge to their same assumptions in *isvara-vada* or the doctrine of God! This led them to refute both naturalism and theism with practically the same zeal.

From all these we are led to think that *svabhava-vada*, at least in its earlier stage, was some form of an independent world-view without a rigid affiliation to any definite philosophical system. But this does not mean that such affiliation never grew. On the contrary, the Indian materialists and philosophers with pronounced materialistic proclivity saw in this naturalism distinct possibility of fortifying their own philosophical positions, particularly against the theists and their doctrine of the creation of the world by a divine agency. This was more or less obvious in the case of the Lokayata and Samkhya and perhaps also in the case of the ancient Indian atomists. In all presumption, therefore, Indian atheism was science-motivated in the case of these philosophers, i.e. of the materialists and near-materialists.

But the question of the atomists, as we shall presently see, is extremely controversial. For the present, let us keep ourselves confined to the Lokayata and the Samkhya whose acceptance of naturalism was more or less clear.

3. SVABHAVA IN LOKAYATA

An early evidence of associating the doctrine of *svabhava* with the materialistic outlook is to be found in a passage of the *Mahabharata*. According to this, those who thought that the material elements alone were ultimately real subscribed to the doctrine of *svabhava* : *svabhavam bhutacintakah.*[17]

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[15] v. 110ff.

[16] Gunaratna 13f.

[17] Santiparvan 232. 19.

That the word *bhutacintakah* here referred to the materialists will not be doubted. However, this was a way of referring to the materialists without mentioning the name of their philosophical school or system. What, then, was this name? The obvious answer would be that this was Lokayata, alternatively also known as Carvaka or Barhaspatya. Accordingly, in the comparatively later Indian literature we find the doctrine of *svabhava* repeatedly and unhesitatingly attributed to the Lokayatas.

Commenting on the *Brhat-samhita*, Bhatta Utpala[18] said, "Others, i.e. the Lokayatas, claimed that the cause of the world was *svabhava*. From *svabhava* arise the variegated world and because of *svabhava* it is eventually destroyed." Agnicit Purusottama[19] asserted, "According to the Carvakas, *svabhava* itself is the cause." Madhavacarya,[20] in accordance with the same tendency, made the Lokayatas argue as follows :

> [But an opponent will say :] if you thus do not admit *adrsta* ('the unseen' i.e., the unperceived intermediate stages between the performance of an act and its final result) the various phenomena of the world would be just fortuitous (*akasmika*). However, (answer the Lokayatas) this is not properly said, inasmuch as it (i.e. the causation of all phenomena) is adequeately explained by *svabhava*. As it is said :
>
> 'The fire is hot, the water cold, and air is neutral
> (i.e. neither hot nor cold) to touch.
> By whom are all these varieties created ?
> Because of *svabhava*, all these are so.'

On the basis of evidences like these, it has practically become a part of the accepted convention of our modern scholars to associate naturalism with the standpoint of the Lokayatas. As Gopinath Kaviraj[21] puts it, "The earliest representatives of the extreme form of *svabhava-vada* seem to have been a set of free thinkers in ancient India, who were originally called the Lokayatas but subsequently came to be more widely known under the name of the Carvakas. Rank materialism, an absence of belief in the unseen and of regard for authority, an uncompromising rationalism

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[18] Quoted by G. Kaviraj in SBS ii. 95n.

[19] Quoted *ibid*. ii. 98n.

[20] Madhavacarya SDS (Anand. ed. 1928) 4.

[21] G. Kaviraj in SBS ii. 95.

—more properly casuistry (*vitanda*)—were their original characteristics."

4. SVABHAVA IN SAMKHYA

It is not the place for us to ask how far the charge of casuistry (*vitanda*) commonly levelled against the Lokayatas, particularly in the Buddhist sources, was actually justified.[22] Instead of that we may keep ourselves confined here to the question of ancient Indian naturalism. That the Lokayatas did subscribe to it is admitted by all. What is not usually admitted—but to which at least some of the foremost of the modern scholars are repeatedly trying to draw our attention—is that the Samkhyas also leaned on *svabhava-vada*. We quote Gopinath Kaviraj again, who clearly points to the logical necessity of the Samkhya philosophers to accept naturalism. "While denying the effectuating power of a *nimitta-karana* (efficient cause), and conceiving matter as moved into action of its own nature (*parinama-svabhava*), the Samkhya, too, approaches the position of a *svabhava-vadin*."[23] While discussing the Samkhya or proto-Samkhya ideas preserved in the *Mahabharata*, Hiriyanna[24] comments that in spite of the acceptance of many souls (*purusa*-s), these ideas resemble the doctrine of *svabhava* "in endowing matter with practically all the power necessary to unfold the whole universe out of itself." Explaining *Nyaya-sutra* iv. 1.22, where the doctrine of *svabhava* was evidently referred to, Ruben[25] draws our attention to the closeness of

[22] This was evidently a simple vilification. *Nyaya-sutra* ii. 2. 3 defined *vitanda* as debate without any positive thesis to establish, whereas the Lokayatas had certainly to establish a positive thesis of their own, which was "rank materialism".—Rhys Davids, carried by the persistent Buddhist references to Lokayata as but *vitanda* only goes to the extent of denying the very existence of a materialist school called the Lokayatas. See Chattopadhyaya and Gangopadhyaya C/L 369ff.

[23] G. Kaviraj in SBS ii. 100n. The reason why Samkhya had inevitably to accept *svabhava-vada* was that, according to it, the evolution of the world took place from *primeval matter by itself*. As Santaraksita (*Tattvasamgraha* verse 7) puts it : "It is out of primeval matter *itself*, alone, as equipped with all potencies, that the various products evolve, really having their essence in that same matter."

[24] M. Hiriyanna OIP 106.

[25] W. Ruben N 103.

the doctrine with the standpoint not only of the Carvakas but also of the Samkhyas, both of which denied God : "The Samkhya was fond of the example of milk which, in the mother, flowed spontaneously—i.e. without any effort of an intelligent original cause in the form of God." Hume[26] proposes an outright identification of the doctrine of *svabhava* as mentioned in the *Svetasvatara Upanisad* vi. 1 with the Samkhya philosophy.

In thus interpreting the Samkhya standpoint as logically leanning on the doctrine of *svabhava*, these modern scholars have the definite authority of at least some of the traditional thinkers. Nilakantha,[27] the commentator on the *Mahabharata*, categorically declared that the doctrine of *svabhava* was that of the Samkhyas : *svabhava iti parinamavadinam samkhyanam*. Commenting on the *Samkhya-karika*, Gaudapada[28] also admitted that according to the Samkhyas there was a cause in the form of *svabhava* : *Samkhyanam svabhavo nama kascit karanam asti*. Samkara[29] clearly explained why this admission of cause in the form of *svabhava* was logically necessary for the Samkhya philosophers. These philosophers, said Samkara, would have argued thus :

> As unconscious milk flows forth from its own nature (*svabhavena eva*) merely for the nourishment of the young animal, and as unconscious water, from its own nature (*svabhavena eva*) flows along for the benefit of mankind, so the *pradhana* also, though unconscious, may be supposed to move from its own nature (*svabhavena eva*) merely for the purpose of effecting the highest end of man.

Samkara explained again[30] the same need for the Samkhya philosophers to depend on the doctrine of *svabhava* :

> Just as grass, herbs, water, etc., independently of any other instrumental cause (*nimitta-antara-nirapeksa*) transform themselves by their own nature (*svabhavat eva*), into milk, so we assume, the primeval matter also transforms itself into the Great Principle (*mahat*) and so on. And, if you ask how we know that grass transforms itself independently of any instrumental cause, we reply, 'Because no such cause is observed.' For, if we did perceive some such cause, we certainly

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26. R. Hume TPU 8.
27. Nilakantha on Santiparvan 232, 21.
28. On *Samkhya-karika* verse 27.
29. On *Brahma-sutra* ii. 2, 3.
30. *Ibid*. ii. 2, 5.

should apply it to grass etc., according to our liking, and thereby produce milk. But as a matter of fact, we do no such thing. Hence the transformation of grass and the like must be considered to be due to its own nature merely, and we may infer therefrom that the transformation of the primeval matter is of the same kind.

We may now sum up our discussion so far. In the conflict of *isvara-vada* with *svabhava-vada* we have one of the earliest glimpses of the struggle between religion and science in the history of Indian thought. The doctrine of *svabhava* could have originally been an independent world-view without a rigid affiliation to any definite system of philosophy. Nevertheless, the materialistic and near-materialistic philosophers saw in this doctrine definite possibility of strengthening their own standpoints, and therefore leaned on it. This is quite clear in the case of the Lokayatas and the Samkhyas.

5. SVABHAVA IN NYAYA-VAISESIKA

Though it would be almost an outrage for those accustomed only to the orthodox understanding of the Indian philosophical tradition, objectivity requires that we raise also the question of the original attitude to the view of *svabhava* of the philosophy usually mentioned in its amalgamated form as Nyaya-Vaisesika, the essential features of which were logic and atomism. It is rather well known that the later representatives of this philosophy were renowned for their elaborate defence of the theistic position, conceiving God as the "efficient cause" or *nimitta karana* of the world-creation. Such a view hardly leaves any scope for *svabhava* —of nature or natural law accounting for the infinite multiplicity of the world, in the ultimate analysis God being the efficient cause of everything, permitting the atoms only the place for being the material cause of the world. But could it be that in taking such a view the later representatives of the philosophy were really deviating from the position of its founders? The presumption is that this was so, judged from the internal evidence of at least one of the source-books of this philosophy, namely the *Nyaya-sutra* attributed to a certain Gotama or Gautama.

Evidently, the crucial question in this connection is the attitude expressed in this text to the very concept of the *nimitta-karana* or efficient cause which, if denied, can leave room only for *svabhava* or the law inherent in nature itself.

Brushing aside the stupendous capacity of tortuous textual interpretation of some of our traditional scholars, let us concentrate here on the plain or direct meaning of three consecutive aphorisms or *sutra*-s in the text.

The three *sutra*-s mean :

> "Existing things originate without any efficient cause [i.e. are due to the mere material cause], because of the observed sharpness of the thorn etc." [iv. 1. 22]
>
> "Absence of the efficient cause, being itself a form of efficient cause, the [alleged] absence of the efficient cause in untenable." [iv.1.23]
>
> "The objection is unsustained, because of the clear difference in meaning between '[there is] an efficient cause' and 'the absence of the efficient cause'." [iv. 1. 24]

How are we to understand the *sutra*-s ? The first point to be noted is that even on the admission of the orthodox Vacaspati Misra, these three *sutra*-s constituted a complete section (*prakarana*) of the text. This amounts to the admission that in the third of the above aphorisms we are to see the final position of the author of the text on the topic concerned. But this third aphorism was clearly in answer to an objection raised in the immediately preceding one. In other words, in the second *sutra* above we are to look for a *purva-paksa* or the position of the opponent. But the normal procedure for a writer was to raise a possible objection against his own position immediately after stating it. Therefore, assuming this textual order, we are to see Gautama's own position with regard to the topic under discussion in the first of the three *sutra*-s quoted above.

Admitting this, the discussion contained in the three *sutra*-s was briefly as follows. Gautama stated that there was no efficient cause or *nimitta-karana* of the world. To this he raised a possible objection that even the denial of the efficient cause amounted to a tacit admission of it. Gautama finally answered that such a verbal manoeuvre was futile, because the admission of an efficient cause and its denial had clear and distinct meanings.

These three *sutra*-s, it needs to be remembered again, immediately followed those in which Gautama argued against the possible existence of God. The logical sequence of his discussion is thus clear. The denial of God in the sense of the dispenser of the results of human actions entailed the question : "But is there no efficient cause of the world?" In other words, even admitting that as the dispenser of the results of human action the concept of God was an undue one, there could have been the question of admitting His existence in the sense of the efficient cause or *nimitta-karana* of the world, inasmuch as the world could not be viewed as coming into being from its material cause alone. As against this, Gautama argued that there was no need at all for assuming any efficient cause of the world. But, then, how could the world come into being out of the mere material cause? Gautama's answer to this was extremely striking: *because of the observed sharpness of the thorn etc.* This was undoubtedly a cryptic but typical reference to *svabhava-vada* or the doctrine of purely natural causation, the observed sharpness of the thorn etc. being the usual example with which the doctrine was illustrated in the popular verses referring to it. Thus, Gautama, one of the earliest Indian philosophers to have consciously defended the scientific attitude, proposed to reject the doctrine of God in favour of the doctrine of nature. Referring cryptically to the doctrine of *svabhava* by the expression "because of the observed sharpness of the thorn etc.", he argued that the assumption of the efficient cause of the world was redundant, because the material cause, by the laws inherent in its own nature, accounted for the coming into being of the world as we find it.

This reading of the doctrine of *svabhava* in the *Nyaya-sutra* would appear to some of our modern scholars as the limit of absurdity, the reason for this being that the later Naiyayikas like Udayana took special care to refute the doctrine. But here, we can only see the departure of the later Naiyayikas from the original position of the philosophy. However much eager the later exponents of the philosophy might have been to refute the doctrine of *svabhava*, the plain point seems to be that Gautama clearly mentioned the doctrine and did not care to refute it. The presumption therefore is in favour of his acceptance of the doctrine of *svabhava*.

Vatsyayana, the commentator, saw of course that Gautama's discussion of the *nimitta-karana* or the efficient cause of the world contained an explicit reference to the doctrine of *svabhava* but no tendency to refute it at all. Understandably, this made him feel uncomfortable, because, as contrasted with Gautama, Vatsyayana himself took a theistic stand. Therefore, in trying to interpret Gautama in accordance with his own preoccupation, Vatsyáyana had to argue that as a matter of fact Gautama did refute the doctrine of *svabhava*. But were exactly in the *Nyaya-sutra* was Gautama supposed to have refuted the doctrine ? Not surely in the context of his discussion of the controversy between the doctrine of the *nimitta-karana* vs *svabhava-vada*. This discussion clearly concluded with the mention of the futility of the objection claiming that the rejection of the conception of the efficient cause of the world amounted in fact to a surreptitious acceptance of the conception. Gautama summarily discarded the objection as puerile and passed on to some other topic. The plain implication of this was that for Gautama the rejection of the conception of the efficient cause of the world remained valid. And it remained valid for him on account of his acceptance of the doctrine of *svabhava*. But this plain implication of the discussion was for Vatsyayana extermely distasteful. He had therefore to seek for some other place of the *Nyaya-sutra* in which the refutation of the doctrine of *svabhava* could be attributed to Gautama. Where was such a place ? Vatsyayana argued that in this section on the doctrine of *svabhava vs* the doctrine of the *nimitta-karana*, Gautama did not care to refute the former, because he had already refuted the former in *Nyaya-sutra* iii.2.61ff, in connection with the question whether the origin of the living bodies was due to *karma* or not.

However, let us see here some of the difficulties in accepting this interpretation proposed by Vatsyayana. To begin with, the admission of this amounts to a tacit denial of an intelligent plan followed by Gautama in the *Nyaya-sutra*. According to Vatsyayana's interpretation, Gautama refuted the doctrine of *svabhava* in the third chapter of his work, returned to it in the next chapter, where, after raising a puerile objection against it and showing the puerility of the objection itself, passed on to discuss something else altogether. This could not evidently be an intelligent plan followed in a philosophical work—particularly a *sutra*-work in which the economy of words was considered the highest form of literary merit. Secondly, the actual passages of the *Nyaya-sutra* referred to by Vatsyayana in which the superfluity of the doctrine of the efficient cause of the world was alleged to have been already refuted by Gautama, when properly examined, shows only the refutation of a superficially similar view. The real question discussed there was concerning the origin of the living bodies and Gautama, with the extremely limited knowledge of embryology available in his time, argued that more factors than the mere atoms were involved in the process of foetal development. One of these factors, according to him, was *adrsta* or "the unseen". This doctrine of the *adrsta* in the Nyaya-Vaisesika philosophy—and its relation to the doctrine of *apurva* of the Mimamsakas—is in need of a detailed investigation and we do not have the scope here to digress into it. What concerns our present argument, however, is that the conceptions of the *adrsta* and of the *nimitta-karana* were fundamentally different and therefore Vatsyayana's claim that the acceptance of the former by Gautama in one context necessarily meant the acceptance of the latter by him in another is groundless. By the *nimitta-karana* of the world was meant something essentially conscious. It was the conception of the conscious agent acting as the efficient cause of the world. The *adrsta*, by contrast, was something inherently unconscious. Samkara went to the extent of comparing it with a piece of wood or metal. The Nyaya-Vaisesikas themselves also conceived it as a purely material force, some of the examples with which it was illustrated in the *Vaisesika-sutra* being the movement of the needle towards the magnet and the upward movement of the water in the plant-bodies. The mention by Gautama of such an essentially material force as a factor contributing to the foetal development could therefore hardly be interpreted as his rejection of the doctrine of *svabhava* in favour of the *nimitta-karana* or the efficient cause of the world.

Notwithstanding Vatsyayana, therefore, there are grounds to think that Gautama himself wanted to defend the doctrine of *svabhava* as against the doctrine of an intelligent efficient cause of the world.

6. SVABHAVA-VADA AND NATURAL SCIENCE

We have so far concentrated mainly on the philosophical literature and this for the purpose of determining the exact implication of the doctrine of *svabhava*. We have seen that it formed an important feature of the new intellectual climate ushered in by the Second Urbanization and further, notwithstanding differences among the modern and medieval scholars of looking back at it, the concept itself at least foreshadowed what came to be known in later times as the Laws of Nature.

With the clarification of this point, we may now turn to our central theme, viz., the formation of the theoretical fundamentals of natural science. That generally speaking the concept of the Laws of Nature formed an essential feature of such theoretical fundamentals of natural science, or, in other words, without the admission of it, natural science is really not possible, need not be discussed at length, notwithstanding immense complexities introduced into the concept itself by a number of very recent findings specially in physics and mathematics. What we are ourselves concerned with, however, is science in the ancient world and more specially as far as it developed in the Indian sub-continent. So our present question is rather specific. Do we have any definite evidence of the concept of *svabhava* significantly contributing to the making of natural science in ancient India?

We shall later see that it actually did. As a matter of fact both the early compendia of medical science are quite outspoken about the need of accepting the view of *svabhava*. We shall further see that the basic theoretical framework within which our ancient doctors moved, required this assumption and without this assumption even their therapeutic technique could hardly have any real justification. We shall return to this point while discussing the *Caraka-Samhita* and *Susrutha-Samhita* in some detail.

There remains only another question to be raised in this connection. Could it be that the science of astronomy, too, as far as it developed in ancient India had to lean on the concept of *svabhava*, implicity even if not always expressed in so many words? The answer to this is in the affirmative, specially from the time when astronomy in ancient India took a rather sharp turn to natural science, scrapping for the purpose many an alien idea once associated with it. We propose to discuss it in our later volume on astronomy.

CHAPTER 6

INTELLECTUAL TURMOIL : BUDDHIST AND JAINA SOURCES

1. PRELIMINARY REMARKS

Depending mainly on the *Upanisad*-s, we have so far discussed some stray evidences suggesting the changed intellectual climate preparing the soil for the growth of rational natural science. A systematic survey of the *Upanisad*-s gives us the idea of how profound had been the intellectual turmoil ushered in by the Second Urbanization. The adventure of ideas followed so many directions that an objective study of these texts froms the subject-matter of an independent study altogether. We have neither the scope nor the need of it for our present discussion. But we shall presently have to return to the *Upanisad*-s to have an adequate understanding of the first scientist systematically unfolding his views of nature and man depending on the method which continued to be recognised as characteristic of natural science for many centuries to come. However, before passing on to this remarkable man, it may be worthwhile for us to have some collateral evidences of the intellectual unrest of the period mainly from the early Buddhist and Jaina sources.

But one clarification is at once called for. Buddhism and Jainism are considered dissident sects from the viewpoint that has somehow acquired the status of Hindu orthodoxy. Though starkly atheistic in their basic emphasis both are somehow recognized as religious sects. Yet, as we shall presently see, the theoretical fundamentals of both early Buddhism and Jainism were not without very significant contributions to the making of science—the former with its theory of causality and the anticipation of a dialectical outlook extended even to sociology and the latter foreshadowing a logical structure peculiarly throwing some new light on the apparent riddles created by experiments in recent science. As a result of this some of the renowned working scientists are taking a renewed interest in the ancient Jaina standpoint. The theoretical fundamentals already worked out by ancient Buddhists and Jainas are thus not without fascinating science-potentials after all.

However, reserving for the future the discussion of all these, let us concentrate here on our present point. It is concerning the intellectual turmoil ushered in by the Second Urbanization. For this purpose we shall have a few words on how the early Buddhist and Jaina sources, which were also the products of the new turn of events from *c.* 600 B.C. supplement the impression we have from the *Upanisad*-s.

2. SIXTY-TWO HERESIES FROM THE BUDDHIST STANDPOINT

The *Brahmajala-sutta*, a dialogue composed in the Pali language and considered canonical by the early Buddhists, is designed to show what a wide range of views the Buddha had to controvert in defence of his own. The analogy used in the text is that of the fisherman catching with his net all the fishes in a pond so that it becomes clear of the disturbing elements. As the text puts it :

> Bhikkhus ! When any of the samanas and brahmanas who speculate on the past, or the future, or both the past and the future, and adhere to beliefs relating to them, assert the many and varied (wrong) views about the past, or the future, or both, all of them are caught in the net of this discourse with all their sixty-two categories of wrong views, and if they try to rise (or sink) they rise (or sink) within the net, for all their views fall within the net of this discourse.
>
> Take this simile, bhikkhus ! When a skilful fisherman or his apprentice spreads out a finely meshed net on the waters of a small lake, it may occur to him thus :
>
>> 'As all big creatures in the lake have been caught in the finely meshed net, if they rise to the surface (or sink), they do so within the net. As they are all contained in the net, if they rise (or sink), they do so all within the finely meshed net.'
>
> In the same manner, bhikkhus, when all samanas and brahmanas, speculating on the past, or the future, or both, and adhering to beliefs relating to them, assert their many and varied (wrong) views they do so in sixty-two ways, which all fall within the net of this discourse. And as this discourse encompasses all those (wrong) views, if any one of the views comes up, it does so within the compass of this discourse.[1]

We have thus in the text sixty-two major views already in circulation in the Buddha's time and considered highly disturbing—

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[1] DN (BPA) 68.

if not positively heretical—from the Buddhist viewpoint. Sixty-two is not a small number indeed and there is no evidence to think that all these were but verbal concoctions of the early Buddhists. Some of these were of course rather similar to each other ; while enumerating which therefore the text broadly classifies these under two heads. But all these were basically concerned with man or soul (*atta*) and the world (*loka*) as permanent entities.

Of the two categories into which the sixty-two views are classified, the first contains 18 and the second 44. Not that we have the scope here to mention all these views even in any summary form. Nevertheless, for reason to be presently mentioned, we are being tempted to quote here specially one of these. The *Brahma-jala-sutta* mentions a class of views called *amaravikkhepa ditthi* which is sometimes translated as "indecisive evasion", but which in modern terminology may perhaps be put as incipient form of the futility of any categorical assertion. The fourth specimen of it is put as follows :

> In this world, bhikkhus, a certain samana or brahmana is lacking in wisdom and is very bewildered. He evades questions put to him on any matter and speaks in ambiguous terms (in the following manner) as he is lacking in wisdom and is very bewildered.
>
> If I were asked, 'Is there another world ?' and if I took it that there is, I should answer, 'There is another world'. But I would not say this way, nor that way, nor the other way ; neither would I say not this way, not that way, not the other way ; nor would I say otherwise.
>
> If I were asked
> Whether there is not another world...
> Whether there is, and also is not, another world...
> Whether there neither is, nor is not, another world...
> Whether there is *opapatika* birth [*appearing* as full-fledged beings] of beings...
> Whether there is no *opapatika* birth of beings...
> Whether there is, and also there is not, *opapatika* birth of beings...
> Whether it is not that there is, and also there is not, *opapatika* birth of beings...
> Whether a good or a bad *kamma* produces results...
> Whether a good or a bad *kamma* produces no results...
> Whether it is that a good or a bad *kamma* produces results, and also does not produce results...

> Whether it is not that a good or a bad *kamma* produces results, and also does not produce results...
>
> Whether there is life after death...
> Whether there is no life after death...
> Whether there is life as well as no life after death...
>
> Whether it is not that there is life as well as no life after death, and if I took it that it is not that there is life as well as no life after death, I should answer : 'It is not that there is life as well as no life after death.' But I would not say this way, nor that way, nor the other way ; neither would I say not this way, not that way, not the other way ; nor would I say otherwise.
>
> "Bhikkhus ! This is the fourth possibility. It is based on this reason that some samanas and brahmanas who are elusive evade questions put to them on any matter and speak in ambiguous terms.[2]

3. THE SIX HERETICS

We have quoted the above because the view under consideration seems to be precariously near to the one attributed to a certain Sancaya Belatthaputta (= Sanjaya Belatthiputta) in the Pali dialogue called *Samannaphala-sutta*—an oft-quoted text on which the modern scholars basically depend for the information about the six famous heretics in Buddhist India, among whom Sanjaya Belatthiputta happens to be one. For our own purpose of illustrating the intellectual unrest of the period we shall have to quote the views of all the six of them as well as the context in which these occur in the text, because the context itself is not without interest for understanding the contemporary society of the Buddha.

The text wants us to believe that King Ajatasattu (= Ajatasatru) of Magadha, the son of Queen Videhi, had once the curiosity to know the palpable benefit in this life itself of the life of a recluse, as palpable in the other vocations in society. As the text formulates the question raised by Ajatasatru before the Buddha :

> "Venerable Sir ! There are (men of) various callings. And what are they ? They are :
>
> Elephant riders ; horse riders ; charioteers ; archers ; standard-bearers ; military strategists ; commandos ; men of royal birth prominent as war-

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[2] *Ibid* 40-41.

riors ; members of striking forces ; men brave as elephants ; men of valour ; mail-clad warriors ; trusted servants ; confectioners ; barbers ; bath attendants ; cooks ; garland-makers ; washermen ; weavers ; reed-mat makers ; potters ; arithmeticians ; and accountants. Besides them, there are men of many other callings. All those skilled in them enjoy the fruits of their proficiency in this very life. They make themselves well-fed and happy. And so do they make their mothers and fathers well-fed and happy, their wives and children well-fed and happy, and their friends well-fed and happy. They engage themselves in the practice of making gifts to samanas and brahmanas with a view to attaining the higher realms, the abodes of devas, and obtaining happy and beneficial results. Can you, Venerable Sir, reveal to me the advantages to be gained in this very life from being a samana, similiar to the advantages accruing from these callings ?[3]

The Buddha asked the king if he had made the same enquiry to anybody else before coming to him. As a matter of fact, on the advice of his different ministers, the king was supposed to have put the same question to the six famous ascetics of his time, each described in the stereotyped words : "who has a group of disciples, with his own sect, being the teacher of his sect, reputed and well-known, the founder of a school of thought, acclaimed by many as virtuous, ripe with experience, having spent long years as an ascetic, with knowledge of the olden days, and far advanced in age".[4] But the king found their answers as totally irrelevant, or, in the words of the text : "It is as if, when asked about a mango tree, he explains what a breadfruit tree is, and when asked about a breadfruit tree he explains what a mango tree is."[5]

Thus dissatisfied with the answers the King had at last, on the advice of the physician Jivaka, approached the Buddha, to whom he first reports what the other reputed preachers had to say. What the king reports are for us the primary sources of information of the six famous heretics from the Buddhist viewpoint which therefore we quote as described in our text to have been directly addressed to the King[6] (We quote below five of these because the creed attributed here to Sancaya Belatthaputta also occurs in the *Brahmajala-sutta* in greater details which we have already cited):

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[3] *Ibid.* 78.

[4] *Ibid.* 73.

[5] *Ibid.* 80.

[6] *Ibid.* 79-88.

The creed of Purana Kassapa

One who acts or causes others to act, one who mutilates or causes others to mutilate, one who torments or causes others to torment, one who inflicts sorrow or causes others to inflict sorrow, one who oppresses and causes others to oppress, one who threatens or causes others to threaten, one who kills or causes others to kill, one who steals or causes others to steal, one who breaks into houses or causes others to break into houses, one who raids or causes other to raid villages, one who robs or causes others to rob, one who commits or causes others to commit highway robbery, one who commits or causes others to commit adultery or one who tells lies or causes others to tell lies is not deemed to have done evil even though he has done (these things). Even if one cuts up all beings on this earth into a pile or a heap of flesh with a grinding wheel fitted with razors, evil will not be caused. No evil ensues therefrom. Even if anyone living on the south bank of the Ganges should kill or cause others to kill, mutilate or cause others to mutilate, or torment or cause others to torment, no evil is done. No evil ensues therefrom. Even if anyone living on the north bank of the Ganges should give alms or cause others to give alms, or make offerings or cause others to make offerings, no meritorious action is done. No merit ensues therefrom. Such actions as giving in charity, controlling the senses, observing morality and speaking the truth will not bring about meritoriousness. No merit ensues therefrom.

The creed of Makkhali Gosala

There exists no cause or condition for beings to become defiled ; they are defiled without cause or condition. There exists no cause or condition for beings to become absolutely pure ; they are absolutely pure without cause or condition. There is no such thing as action done by oneself, nor action done by another for the sake of oneself, nor action done by men. There is no power, no energy, no human strength and no human endeavour. All sentient beings, all those that breathe, all those that exist, all those that possess the principle of life are devoid of power, energy, strength and endeavour. They just happen naturally, by chance and according to their own individual character. They experience pleasure and pain in accordance with the various positions they occupy in their hierarchy of six kinds of births. There are one million four hundred and six thousand six hundred main types of beings. There are five hundred kinds of actions (*kamma*), or else five, or else three ; and there are complete actions as well as half actions. There are sixty-two methods of religious practices, sixty-two world cycles, six categories of special castes, eight stages of man, four thousand and nine hundred modes of living, four thousand and nine hundred kinds of wandering ascetics, four thousand and nine hundred abodes of *naga* serpents, two thousand faculties of the senses, three thousand abodes of suffering (*niraya*), thirty-six repositories of atoms of dust, seven kinds of rebirth with consciousness (*sanna*), seven kinds of rebirth without consciousness, seven kinds of reproduction by budding and grafting, seven kinds of devas, seven kinds of human beings, seven kinds of sprites, seven kinds of lakes, seven kinds of great prominences, seven hundred small prominences, seven great chasms, seven hundred small chasms, seven major dreams and seven hundred minor dreams. And then there are eighty-four hundred thousand great cycles of time during which the fool and the wise alike, wandering from one existence to another, will at last put an end to the round of suffering. In the meanwhile there will be no end (of it). No one can say : 'By the practice of this morality and conduct, of this austerity, of this chastity, I shall make my immature actions grow into maturity, at the same time destroying mature actions by repeated encounters.' All happiness and misery have been measured in the measuring basket ; and the round of rebirths is in this way delimited, with no extension or reduction. When a ball of string is thrown forward, it will go as far as the length of the string allows. In like manner both the fool and the wise would wander from one existence to another as far as they can go, and ultimately make an end of the round of suffering.

The creed of Ajita Kesakambala

There is no (consequence to) alms-giving, sacrifice or oblation. A good or bad action produces no result. This world does not exist, nor do other worlds. There is no mother, no father, (all good or evil done to them producing no result). There is no rebirth of beings after death. In this world, there are no samanas or brahmanas established in the Noble Path and accomplished in good practice, who through direct knowledge (i.e. *magga* insight) acquired by their own efforts, can expound on this world and other worlds. This being is but a compound of the four great primary elements ; after death, the earth-element (or element of extension) returns and goes back to the body of the earth, the water-element (or element of cohesion) returns and goes back to the body of water, the fire-element (or element of thermal energy) returns and goes back to the body of fire, and the air-element (or element of motion) returns and goes back to the body of air, while the mental faculties pass on into space. The four pall-bearers and the bier (constituting the fifth) carry the corpse. The remains of the dead can be seen up to the cemetry where bare bones lie greying like the colour of the pigeons. All alms-giving ends in ashes. Fools prescribe alms-giving ; and some assert that there is such a thing as merit in alms-giving ; but their words are empty, false and nonsensical. Both the fool and the wise are annihilated and destroyed after death and dissolution of their bodies. Nothing exists after death.

The creed of Pakudha Kaccayana

There is this group of seven which is neither made nor caused to be made, and neither created nor caused to be created. These seven are sterile, permanent as a mountain peak and firm as a gate post. They are unshakable, immutable, unable to harm one another and incapable of causing pleasure or pain or both pleasure and pain to one another. And what are those seven ? They are : the body of earth, of water, of fire, of air ; pleasure, pain and the soul.

These seven are neither made nor caused to be made, and neither created nor caused to be created. They are sterile, permanent as a mountain peak and firm as a gate post. They are unshakable, immutable, unable to harm one another and incapable of causing pleasure or pain or both pleasure and pain to one another. Among the seven there is neither killer nor one who causes killing, neither hearer nor one who causes hearing, neither knower nor one who causes knowing. When one cuts off another's head with a sharp weapon, it does not mean that one has killed the other, for the weapon only falls through the space in between the seven.

The creed of Nigantha Nataputta

In this world a Nigantha is disciplined in four kinds of self-restraint. And what are they? They are as follows. A Nigantha abstains from taking cold water from all sources. He abstains from all (evil), and by such complete abstinence, throws off all (evil), and achieves perfect restraint. O King! A Nigantha who is disciplined in these four kinds of self-restraint is deemed to have become perfected in self-discipline, self-restraint and steadfastness.

The creed of Sancaya Belatthaputta

Basically the same view is already cited in greater details in our Section 2 of the present chapter.

4. ON THE AJIVIKAS

Evidently enough, if such were actually the answers given by the six renowned rivals of the Buddha, the king had every reason to consider the answers irrelevant to his main question concerning the palpable results derived by the recluse. Nevertheless, the views expressed have their own interest. A.L. Basham, interested as he is mainly in reconstructing the history and doctrine of the Ajivika sect—the origin of which must have been as old as the days of the Buddha and continued upto the much later period as attested by the Tamil texts—comes out with the following observation :

"That which is here ascribed to Ajita Kesakambali is a clear expression of materialism, and its author, whether Ajita or another, must have been a forerunner of the later Carvakas. The teaching ascribed to Nigantha Nataputta is very obscure, but, as Jacobi has pointed out, while it is not an accurate description of the Jaina creed it contains nothing alien to it. We may accept the identification of Nigantha with Vardhamana Mahavira, the twenty-fourth *tirthankara* of Jainism. The passage ascribed to Sanjaya Belatthiputta is probably satirical, a tilt at agnostic teachers who were unwilling to give a definite answer to any metaphysical question put to them. Dr. Barua holds another view, and believes that the statement of Sanjaya represents a doctrine which was held in good faith by a school of Pyrrhonists. Whatever the authenticity of this passage, its agnosticism was never a part of the Ajivika creed.....

"We are left with the passages ascribed to Purana, Makkhali, and Pakudha. The doctrines of all three, and the names of two of these teachers are connected with later Ajivikism. The authenticity of the ascription of *niyativada* to Makkhali Gosala may be confirmed by reference to the Jaina scriptures, wherein Gosala Mankhaliputta propounds a very similar doctrine. Pakudha's fantastic atomism and his Parmenidean doctrine of immobility, which follows logically from Makkhali's determinism, are integral parts of the teaching of the Dravidian Ajivikas as described in Tamil texts. Purana is mentioned by name and apparently held in high respect by these later Ajivikas, and his antinomian ethics are quite consistent with Makkhali's metaphysics."[7]

5. TOWARDS NATURE-PHILOSOPHY

The focal point of our own discussion is however a different one. It is the intellectual unrest of the period of the Second Urbanization—an unrest without which the preparation of the soil for the making of natural science is not conceivable and which presumably followed from the secularization of the administrative infrastructure as contrasted with the presumable priest-class domination of the First Urbanization. They very evidence of a large number of views recorded in the *Upanisad*-s supplemented by the Pali canonical works like the *Brahmajala-sutta* and *Samanna-phala-sutta* just mentioned, may be considered adequate for illustrating the intellectual turmoil of the age.

We could have perhaps stopped here hoping to have established the point we are at present driving at. Nevertheless, we are being tempted to add a few more words on the six major heretics from the Buddhist viewpoint because their views have the further interest of giving us at least a glimpse of some seeds, as it were, for the theoretical fundamentals of natural science.

First, Basham in his intensive investigation of the Ajivika sect associated specially with the name of Makkhali Gosala, sees some kind of primitive atomism which is also found—though not exactly in the same form—in the teachings attributed to Pakudha Kaccayana and was even on the point of sprouting in the age as is evident from the history of Jainism.

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[7] A.L. Basham HDA 17-18.

Secondly, the view of matter in certain basic forms or *bhuta*-s (usually translated as "elements") was pressing hard for recognition, as is further evidenced by the list of antitheistic views enumerated in the passage of the *Svetasvatara Upanisad* we have previously quoted. It remains for us to see how basic the view of the *bhuta*-s proved for the theoretical fundamentals of ancient Indian medicine.

However, one very interesting feature of the heresies from the Buddhist viewpoint, though with significant science potentials, remains perhaps least discussed by the modern scholars. It is, in short, exploring alternative possibilities of looking at some proposition and enumerating these possibilities as far as it is feasible. This in short was a veritable intellectual adventure stimulating scientific enquiry the first precondition of which is the breaking down of the rigid barrier of dogmatic assumption in any form. We have already quoted a passage from the *Brahmajala-sutta* remarkably expounding this theoretical tendency though without connecting it with any proper name, simply describing it as elusive evasion of questions and specially concentrating on burning problems of the age—the problems namely of after-life and the other world. In the *Samannaphala-sutta* basically the same theoretical temper is attributed to Sanjaya Belatthaputta by name who, again, analyses similar alternative possibilities and similarly refuses to accept any. This has led B.M. Barua to think that Sanjaya represented a doctrine which was held in good faith by a school of Pyrrhonists.[8] That apparently at any rate there was a certain amount of similarity between Sanjaya's position and that of the Greek sceptics is not to be denied. What needs also to be noted in this connection appears to have some special interest for us. The sceptics seemed to have refused philosophical view as such without giving us the impression of methodically analysing the possible alternatives of looking at the view itself, which Sanjaya is reported to have done. As a result there was no possibility of scepticism in its usual sense stimulating the scientific and philosophical enquiry beyond an obvious limit. When, however, the starting point of the rejection of dogmatically adhering to any positive view is a methodological analysis of the alternative possibilities with regard to the view itself, there may open up before the thinkers certain new and positive ways of approach altogether. In the ancient Indian subcontinent, this seems to have actually taken place in two major forms. We may very briefly note these.

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[8] B.M. Barua HPIP 325 ff.

6. DOUBT : THE STARTING POINT

First, the history of scientific method in Indian culture. We shall presently see that it was foreshadowed in a very significant trend of thought already in the Upanisadic period. It was next taken up by the medical circle where it was much enriched. But the climax of this process reached among those philosophers who were taking the keenest interest in the problems of logic and epistemology. The school they represented, namely Nyaya, in the work that comes down to us as its source-book, the *Nyaya-sutra*, strongly argued that *samsaya* or doubt had to be accepted as the only legitimate starting point for an enquiry in the mystery of man and nature. This is reminiscent of Descartes, who also took doubt as the point from which true philosophy begins. But the Cartesian doubt was very different in spirit and intention from the doubt or *samsaya* as understood in the *Nyaya-sutra* and elaborately explained by its commentator Vatsyayana. For Descartes it was intended to be mainly a tactical way to remove the intellectual debris accumulated during the Middle Ages by the Churchmen, any direct confrontation with whose authority entailed the risk of inquisition. So Descartes professed to begin with the absolutely indubitable and claimed that the only path leading to it was to begin with some kind of uncompromising doubt.

The *Nyaya-sutra*, too, claimed that without doubt or *samsaya* there could be no beginning of a legitimate enquiry at all. But its understanding of doubt itself was quite different. It was necessary first of all to establish the legitimacy of doubt itself and the only way of establishing it was to show alternative possibilities—called thesis (*paksa*) and anti-thesis (*vipaksa*)—of the way of looking at the theme to be discussed. One wanting to discuss anything at all had thus to establish first that there were alternative—and in fact antagonistic—possibilities of looking at it. Thus, for example, before discussing anything about the soul and future life, one was first of all obliged to establish that the problem was a legitimate one and the only way to prove this legitimacy was to establish again that there was a doubt (*samsaya*) about it and the only way of establishing such a doubt was to show that there were alternative and antagonistic views about soul and after life.

So the point of alternative and opposite possible views was lurking behind the basic methodology recommended in the *Nyaya-sutra.* But the need to take note of the alternative ways of looking at some problem was already felt in Buddhist India by Sanjaya and his brother philosophers. Confronted with the problem of the alternatives, however, they seem to have given up the hope of moving further forward and declared that the prospect of arriving at any firm footing or in sticking to some view or other was better abandoned as a hopeless one. For all that we know, such a feeling was the main cause of what appears to us as their "scepticism".

With the Nyaya philosophers, however, it was different. The alternative ways of looking at a problem—alternative that wanted to annihilate each other—posed on the contrary some form of intellectual challenge for them and thereby stimulated the zeal for further probing. These were thus for the Nyaya some kind of stimulant for the formation of the right methodology of all enquiries. Hence they claimed that the doubt or *samsaya* raised by the contradiction between the "thesis" (*paksa*) and "anti-thesis" (*vipaksa*) was the only starting point of enquiry, implying in their own way that the surrender to it could just be an index to intellectual feebleness. Nevertheless those who were the earliest to point to the basic possibility of the alternative ways of viewing things were, historically speaking, playing an exceedingly significant role inasmuch as they were the first to initiate a process that eventually proved the starting point of the scientific methodology. Could it thus be that Sanjaya and his associates in Buddhist India anticipated a process which *passing through the medical circles,* eventually assumed the form of the scientific method in the *Nyaya-sutra* and remained as the standard one in India for centuries to come ?

It perhaps requires a few words in explanation of emphasizing the expression "passing through the medical circles". S. N. Dasgupta[9] has already drawn our attention to the possibility of the Nyaya logic and epistemology emerging from these in the *Caraka-samhita.* A careful comparison of the *Nyaya-sutra* with the *Cara-*

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[9] S.N. Dasgupta HIP ii. 392 ff.

ka-samhita makes it most difficult to question such a possibility. At the same time, as we shall later see more fully, Dasgupta's observation is in need of addition of at least one point. When we analyse the *Caraka-samhita* with critical care,[10] the same point that we have been discussing leaps before our eyes. The clash of alternative possibilities of viewing a problem constitutes the crux of the methodology also of the *Caraka-samhita*, different though was the form in which it was expressed. An important peculiarity of the medical compilation is the emphasis put on the need of debate or symposium. That it was more than a mere norm and was put into actual practice in the circle of the physicians is further evidenced by the frequently occurring descriptions of symposia or seminars in the text, in which different authorities are found to express different and mutually antagonistic views on the same topic. There is moreover a fairly long discourse in the medical compilation insisting on the importance of debate among the practising physicians. That had been one of the characteristic ways in which the ancient medical authorities acknowledged that without moving through the clash of ideas expressed as alternative views concerning the same theme there could be no method of science.

7. SYADVADA AND ANEKANTAVADA

All this brings us back to the main point we have been discussing. As testified by the Pali canonical works, during the intellectual turmoil of the Second Urbanization, we come across a tendency among some thinkers of whom a certain Sanjaya was presumably the most prominent. In the Pali text they are generally described as typical 'evadors", which, in our terminology, means those that took a basically sceptical stance. What particularly interests us here is not their conclusion but the premise from which they started. And the main point about this premise is that they showed the alternative possibilities of looking at the same theme and the basic incompatibility or contradictions involved in these alternatives. But total scepticism was not the necessary outcome of such a premise. There is scope, on the contrary, of looking back at this premise as some kind of stimulant to the making of the scientific method in Indian thought, first fully formulated in the *Nyaya-sutra.*

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[10] See *infra* Chapter 8.

But our discussion of the premise of Sanjaya and his brotherhood in Buddhist India does not end here. The zeal of pointing to the alternative possibilities of looking at the same theme gave to the Indian cultural heritage another result, the astonishing possibilities of which are being increasingly realized by eminent working scientists of our time. This is technically known as *anekanta-vada* with its logical foundation called *syad-vada*—the former literally meaning 'doctrine of the multifarious aspects of an object' and the latter 'the doctrine of may be (or, better, *somehow*)'. This view developed among those that professed Jainism as their creed though how far the creed itself was internally connected with the view along with its logical foundation is a different question, into which we need not try to enter at the present stage of our discussion. What concerns us here are the implications of the view itself and the formulation of its logical foundation.

Anekanta-vada briefly means that everything has actually multifarious aspects and hence can really be understood from various viewpoints—each being equally valid. None of these views taken by itself can exhaust the full nature of the object under consideration and hence any assertion about it has to be qualified by the epithet *syat* 'somehow'. Where this trend of thought differs from any other is that it attempts to enumerate fully or comprehensively all the possible ways of referring to something, naturally adding to each of these the epithet "somehow" or *syat.* But the possible alternative ways of looking at something is not unlimited. Logically analysed these can be satisfactorily enumerated as seven and seven only. That leads the Jaina logicians to formulate their famous sevenfold formula which accordingly is called *saptabhangi.* These seven are :

(1) "Somehow, it is" (*syat asti*)
(2) "Somehow, it is not" (*syat nasti*)
(3) "Somehow, it is and it is not" (*syat asti nasti*)
(4) "Somehow, it is inexpressible" (*sayt avaktavyah*)
(5) "Somehow, it is and is inexpressible" (*syat asti ca avaktavyah*)
(6) "Somehow, it is not and is inexpressible" (*syat nasti ca avaktavyah*)

(7) "Somehow, it is and is not and is inexpressible" (*syat asti ca nasti ca avaktavyah*).

The methodology suggested above for a comprehensive list of possible alternative ways of looking at something, qualifying each by the epithet *syat* or "somehow", appears to be extraordinary indeed. But it would not thus appear if we try to understand it from the viewpoint of the basic stance on which it is based, namely that reality is too complex to come under any simple and categorical characterization. Taking the word *syat* actually to mean "potential mood", Hiriyanna[11] proposes to explain the crux of the view as follows :

"It signifies that the universe can be looked at from many points of view, and that each view-point yields a different conclusion (*anekanta*). The nature of reality is expressed completely by none of them, for in its concrete richness it admits all predicates. Every proposition is therefore in strictness only conditional. Absolute affirmation and absolute negation are both erroneous. The Jainas illustrate this position by means of the story of a number of blind people examining an elephant and arriving at varying conclusions regarding its form while in truth each observer has got only a part of it. The doctrine indicates extreme caution and signifies an anxiety to avoid all dogma in defining the nature of reality."

By way of what is technically called *vrddhasammati*, lit. 'sanction of the elders', we may perhaps mention here one point. A Buddhist scholar of no less stature than Dharmananda Kosambi mentions in his work *Bhagavan Buddha*[12] the distinct possibility of the logic of *syadvada* developing out of the views attributed to Sanjaya Belatthaputta in the Buddhist texts. In the Pali text Sanjaya's view is referred to as *vikkhepavada*, the nearest English equivalent of which would perhaps be 'the theory of equivocation'. It thrives, as we have seen, on alternative possibilities of looking at the same thing, though Sanjaya himself is described to negate all such possibilities. The step taken by the Jainas from this suggestion is, on the contrary, the affirmation of the validity of all ways of looking at the thing and further, the summing up of all such possibilities under seven broad heads. Dharmananda Kosambi therefore remarks :

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[11] M. Hiriyanna OIP 163.

[12] Dharmananda Kosmabi 161.

"The *viksepavada* of Sanjaya Belathaputta resembles the *syad-vada* of the Jainas and in the course of time the Jainas accepted it as a part of their own philosophy. 'Somehow it is thus, somehow it is also not thus' (*syad asti, syad nasti*)' etc. forming *syadvada* and the aforementioned *viksepavada* of Belatthaputta do not substantially differ from each other. So, could then there be any objection in the assertion that the sect of the Jainas accepted the *viksepavada* as forming the fundamental theoretical position of their own ?."

It is tempting to pause here and come out with some simple implications of the view. Could it be that with all the limitations of the ancient mode of putting the point, these thinkers are groping in their own ways at the position that the understanding of all phenomena depends largely on the observer himself ? The analogy of a number of blind men wanting to have an idea of the elephant is rather a commonplace in ancient Indian literature no doubt. However, if taken as a metaphorical way of expressing the limitations of the human sense-organs—the limitations which the laboratory instruments are ceaselessly trying to overcome—the Jaina theory may acquire novel implications for the scientific community even of later days. So may appear to be their insistence on the fact that every assertion requires to be qualified by "somehow" expressing each a 'potential mood'. That may be reminiscent of the fundamentals of the statistical science, though understandably without its contemporary richness.

All these possible nuances of *anekanta-vada* and *syad-vada* want one to move from ancient thought to a number of startling features of contemporary science. It is thus no wonder that some of our eminent working scientists are being increasingly attracted to the view, though with varied interests : P.C. Mahalanobis with his interest mainly from his specialization in statistical science, J.B.S. Haldane with his interest in examining the relevance of summing up the possible alternative views in the seven-fold formula or *saptabhangi*, and, in a recent startling paper D.S. Kothari with his interest in Quantum Physics in particular.

We are here denied for obvious reasons the scope to go into the detail of all this. Besides we have felt that it is best to leave the modern scientists to speak for themselves. Hence mainly on consideration of procedural expediency, we have proposed to have a special *Appendix* in the present study incorporating not only the contributions of the contemporary working scientists on *anekanta-vada* and *syad-vada* but also an exposition of the Jaina viewpoint as traditionally understood by Sukhlalji Sanghavi who is undoubtedly one of the greatest of the traditional Jaina scholars.

SUMMING UP

Pending thus the further discussion of *anekanta-vada* and *syad-vada*, we may now return to our main theme. What we have been trying to focus on in this chapter is that the Buddhist and Jaina sources supplement the *Upanisad*-s in giving us some idea of the profound intellectual turmoil which the Second Urbanization carried on its heels. One feature of this intellectual turmoil was that a section of thinkers in Buddhist India wanted to reject dogmatic assertions by way of insisting on the alternative possibilities of viewing at anything. From the Buddhist sources we learn that a certain Sanjaya Belatthiputta—perhaps with a band of followers—wanted to drift to total scepticism starting from equal validity or invalidity of alternative possibilities essential for looking at things. What we have tried to show, however, is that this insistence on alternative possibilities was not necessarily destined to culminate in the philosophical despair in the form of abject scepticism. It had also the potential of preparing the soil in which grew the method of science—and this in more than one form—something inconceivable in the First Urbanization with its mandatory spell of superstition required by its very administrative infrastructure. The Second Urbanization with its changed administrative infrastructure brought in a new intellectual climate altogether, allowing for the first time the scientist in full sense to move to the fore.

With this point in mind we now propose to move on to an individual—the product of the new intellectual climate—who has the most amazing stature in the history of ancient science.

CHAPTER 7

UDDALAKA ARUNI : THE FIRST NATURAL SCIENTIST

1. PRELIMINARY REMARKS

Mythological literature of India tells us a story of the ocean being once churned by the gods (*deva*-s) and demons (*asura*-s). As a result there emerged both nectar and poison.

In a sense, this also happens in the philosophico-scientific tradition in ancient India. Out of the ocean of the intellectual turmoil created by the Second Urbanization there emerged a remarkable person whose teachings were both nectar and poison. It was nectar for science and science-orientation and poison for its opposite—for myths, religion and the hangover of magical belief.

His name comes down to us as Uddalaka Aruni. We are going to argue that if we are at all entitled to confer the honour of having been the first natural scientist on an individual, objectivity demands that it should be conferred on him. Such a statement is sure to make many a brow to be raised. It has become an accepted convention that science began in ancient Greece with the step taken to it by one of the reputed sages called Thales, who lived in the seventh-sixth century B.C. From our viewpoint, however, this convention is in need of modification because of reasons to be presently mentioned.

Before passing on to our discussion of Uddalaka I may try to be clear about one point. It is concerning the real historicity of the person. Some of my colleagues—inclusive of my sympathetic critics—have asked me if there is any ground to assume that there was a real person actually bearing such a name on whom I have been wanting to confer the honour of being the first nature-scientist in global history. What we have about him are certain legendary materials after all. But how much of history can be construed of such materials ? I would not try to wriggle out of the difficulty by posing a counter-question, viz. legends apart, how much of solid data remain for us for imputing historicity, say, to Thales ? What I should prefer to point to instead is that from the viewpoint of the history of science such questions concerning the actual names of the ancients appears to have secondary importance. What is significant instead is that we come across in our early texts certain trends of thought that are scientifically significant and that the authors or compilers of such texts preferred to ascribe these to a person—Uddalaka Aruni of the Gautama clan—as having been the initiator of this new direction of systematically investigating nature. Even admitting that the texts have fabricated a fictitious name for such a person or even—a possibility, however, that has hardly any substantial ground to suspect—the situation remains more or less the same for the history of science in India. What is significant for this history is not the name but the direction of thought which at least must have once been an accomplished fact, for there is no other conceivable ground of its having been recorded. Since we have nowhere any suggestion of the person concerned being referred to by any name other than Uddalaka there is no ground to prevent us from referring to him by this name even admitting the remote possibility of such a name having been but a concoction. In short, what interests us is the earliest step being taken to science and not the proper name of the scientist himself. As he is conventionally called Uddalaka Aruni of the Gautama clan and as there is nothing definite that might induce us to deviate from this convention, we shall be mentioning him by this name.

We are going to argue that the view of Thales as having been the first scientist, though acquiring a status of truism in the standard histories of science written so far is in need of serious correction. The science-intoxicated Uddalaka must have been earlier than Thales whose actual teachings moreover give us the impression of having been far more profound from the viewpoint of science-potential than all that we know about Thales.

This, if true, requires us to accept Uddalaka as the first scientist not merely in the Indian sub-continent but in the history of global science. But the historians of science remain unaware of the very name of Uddalaka Aruni while those historians of philosophy who are aware of the name have at best a very garbled and misleading idea of his actual teachings.

The reasons for such a situation are both internal as well as external.

Internally, in his own country, his views are subjected to almost endless distortions, energetic efforts being made for centuries to make him appear as a religion-oriented extreme idealist philosopher. It is not easy to penetrate the veil of mystery under which his real contribution to the making of conscious nature-science remains wrapped up in the history of Indian philosophy generally written.

Externally, most of the historians of science have so far worked under the spell of what is often described as Euro-centrism. Assuming, as they have done tacitly or otherwise, that natural science is an essentially European phenomenon, there is hardly any possibility for them to see the first scientist in what we call today "the third world".

There is no doubt that in recent years this Euro-centrism is considerably weakened, thanks to the works of V. Gordon Childe, J. Needham, J.D. Bernal, and others. Bernal even goes to the extent of using the rather exasperated expression "arrogant ignorance" as forming the main prop of this Euro-centrism.[1] However, the name of Uddalaka as having been a nature-scientist does not occur even in their writings. At least an important reason for this seems to be the internal factor just referred to : no work on Indian philosophy that they can lay their hands on mentions Uddalaka as a nature-scientist at all. Even the best known exponents of Indian philosophy in India and abroad are generally inclined to take him as an extreme spiritual-idealist thinker and this evidently because of at least a millennium-old zeal of the traditional interpreters to depict him so.

There is no doubt that Herman Jacobi[2]—and following him his outstanding student Walter Ruben[3]—go against the stream and propose to interpret Uddalaka's philosophy as representing some form of archaic materialism. Among the Indian scholars, B.M. Barua[4] subscribes substantially to this tendency. But the profound importance of the thinker in the history of science eludes even the notice of Jacobi, Ruben and Barua. Among the recent writers

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1. Bernal 311.
2. H. Jacobi, *Die Entwicklung der Gottesidee bei den Indern,* Bonn, 1923, 11 ff.
3. Ruben SAIT 77 ff.
4. Barua 124 ff.

Erich Frauwallner[5] is about the only one who agrees to look back at Uddalaka as if he is knocking—feebly though—at the gates of science to be opened. Referring to his view, he observes: "One would like to speak of it as an almost scientific attitude."

In any case, he continues, "In the doctrine of the elements already cited from our text of the instruction [by Uddalaka] to Svetaketu, we have to deal with an original and many-sided creation of the human spirit, which deserves, therefore, the highest consideration. It would have been all the more interesting, if we had been able to pursue and understand its origin. But unfortunately, that course remains for us denied. We do not find even once in the tradition a sufficient starting point for even a conjecture. Because, as we have already said, our text of the instructions of Svetaketu stands among the older Upanisads, as completely sporadic and isolated."

What we have to add to this is only a simple point. It is indeed vain to try to trace even once in the Upanisadic tradition any view foreshadowing that of Uddalaka, and this for the simple reason that Uddalaka takes the first profoundly important and comprehensive step from pre-science to science, in which the rest of the Upanisadic literature is disinterested. What we have instead as the dominent trend of Upanisadic thought is the general tendency to disparage science in any form. This is pointedly proclaimed, for example, by Sanatkumara in his teaching to Narada (*Ch. Up.* vii. 1. 1-4). Indeed in the free flight of pure speculation that pervades the Upanisadic philosophy there could be no scope for observation and experiment, and therefore nothing of the nature of natural science. As we shall see, Yajnavalkya, a junior contemporary of Uddalaka who is said to receive royal patronage in a grand scale, bluntly declared that observation or direct perception is much to the distaste of the deities (*pratyaka-dvisah*). This, if accepted, makes natural science palpably impossible. But Uddalaka flouted such a philosophy and could thus take the first step to natural science.

However, Frauwallner himself seems to concentrate more on some stray conclusions Uddalaka wants to arrive at, ignoring what appears to us to be much more important about him, namely, the earliest formulation of the methodology of science, which, specially judged in its ancient context is extremely remarkable. In any case, Frauwallner's assessment of Uddalaka remains an isolated one, without making any dent on the prevalent understanding of the history of science. The net result of all this is that Uddalaka is totally unknown to the historians of science, and this—as we are going to see—in spite of objectively having been the real pioneer of nature-science in global history.

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[5] Frauwallner i. 70.

Perhaps, our point is best introduced by contrasting Uddalaka —both his conclusions and his methodology—with the generally accepted view of the pioneer of science in global history.

2. THALES OF MILETUS

With pronounced bias for Euro-centrism, the otherwise admirable French historian of science Arnold Reymond claims that nature-science owes its origin to the peculiar genius of the Greeks, or more simply to some kind of "Greek miracle". As he observes, "Compared with the empirical and fragmentary knowledge which the peoples of the East had laboriously gathered together during long centuries, Greek science constitutes a veritable miracle."[6] Who, then, is the "miracle maker"? Practically in all the standard works on the history of science and philosophy—i.e. inclusive of those that are free from the crude Euro-centrism—his name is mentioned as Thales of Miletus of the sixth century B.C., or, as E. Zeller wants to be more precise, 624-546 B.C.[7]

"There is no reason to doubt", observes J. Burnet,[8] "that Thales was the founder of the Milesian school of cosmologists, and to all appearance he was the *first human being who can rightly be called a man of science*". Not that Burnet denies the possibility of the survival of primitive beliefs—"Greek or Barbarian"—in the speculations of Thales and his immediate successors (the Ionians). "No doubt these exist, and there may well have been more of them [i.e. primitive beliefs] than we know ; but for all that it is true to say that with Thales and his successors a new thing came into the world." The new thing is "definite scientific achievement."

But what exactly is this achievement ?

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[6] Quoted by Farrington 16.

[7] Zeller 26.

[8] Burnet i.18. Emphasis added.

Since Thales himself leaves for us nothing in writing and since we are confronted with all sorts of floating legends[9] about him not fully in conformity with each other—one, for example, wanting us to believe that as an idle star-gazer he fell into a well, another insisting on his practical wisdom enabling him to earn a lot in olive business—we have to depend on the statements of the more reputed ancient Greek writers to have some idea of his achievements.

Thus we are told by Herodotus that "he had predicted an eclipse of the sun which put an end to a battle between the Lydians and the Medes. That was on May 28 (Old style), 585 B.C."[10]. Not that he understood the real cause of eclipses, which, as Burnet adds, "was not discovered till after the time of Thales and his successors gave quite erroneous and fantastic accounts of them". How, then, could he predict it? V. Gordon Childe[11] answers, "he presumably based his deductions on data derived from Mesopotamia." Burnet makes the point clear: "The Babylonians, however, were equally ignorant on the subject, and yet they predicted eclipses with tolerable accuracy by means of a cycle of 223 lunations."[12]

Thales could have easily learnt the technique from them, for in "Hittite times Mesopotamian influence had been strong in Asia Minor, and Sardeis has been called an advanced post of Babylonian civilization."[13]

So it seems that the mere possibility of Thales predicting an eclipse cannot be indicative of his profound contribution to the making of science.

It is asserted, on the authority of Eudemos, a disciple of Aristotle, that Thales introduced geometry into Hellas and that he *taught* the Egyptians how to determine the height of the pyramids from their shadows and also "invented a method of finding the distance of ships at sea".[14] All this, again, hardly justifies any tendency of looking back at Thales as the maker of mathematical

[9] By far the best collection of such legends is to be found in G.S. Kirk and J.E. Raven, *The Pre-socratic Philosophers*, Cambridge, 1960.

[10] Burnet i. 19.

[11] Childe WHH 220.

[12] Burnet i. 19.

[13] *Ibid.*

[14] Burnet i. 20.

science. Thales is supposed to have done this by using the knowledge of similar right-angled triangles—a knowledge the beginnings of which is traced to ancient Egypt. "It was common knowledge among the peoples of the East that a triangle whose sides were as 3:4:5 had always a right angle, and right angles were laid out by means of this triangle. What we are told of Thales suggests that he invented some further applications of this primitive piece of knowledge, and if so that was the beginning of rational science."[15] The last point of this observation is not unexposed to the risk of over-rating the historical importance of Thales, for, as it is rightly added,[16] there is no reason to doubt that such investigations in Europe bore real fruit much later, i.e. among the Pythagoreans. It is thus really not safe for us to make Thales the real founder of mathematics as a science, even admitting the validity of some legends about him.

We have mentioned two sciences, namely astronomy and mathematics, and have seen that, depending on the legends about him, we may at best allow him the credit of adding a certain amount of elegance—and perhaps also some novel applicability—to a pre-existing body of knowledge. For the actual making of these two sciences, as V. Gordon Childe shows, we have to move much backward in human history—to what he calls "the urban revolution".[17] But we have also seen that in the First Urbanization resulting from this revolution, though mathematics and astronomy came into being during the period, the then prevailing administrative infrastructure required these to remain under the strict surveillance of superstition. Admitting, therefore, the authenticity of the legends about Thales just mentioned we can at best claim that he liberated both the pre-existing sciences from the spell of superstition.

However, in most of the histories of science, the credit of having been the first scientist is attributed to Thales because of his cosmological speculation. We quote Burnet again who gives us an admirably lucid summary of it :

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[15] *Ibid.*

[16] *Ibid.*

[17] Though already occurring in his *Most Ancient East* (1928), Childe elaborates his understanding of it in *Man Makes Himself* (1936) and *What Happened in History* (1942). The main points about it are summed up by him in an essay on "The Urban Revolution" (*Town Planning Review*, Vol. 21, No. 1, pp. 3-7 ; reprinted in *Ancient Cities of the Indus*, ed. G. Possehl, New Delhi 1979).

"According to Aristotle, Thales said that the earth floats on the water and he doubtless thought of it as a flat disc. . . . It sounds primitive enough, but in reality it marks a notable advance. The whole history of cosmology at this date is the story of how the solid earth was gradually loosed from its moorings. Originally sky and earth were pictured as the lid and bottom of a sort of box ; but from an early date the Greeks, as was natural for them, began to think of the earth as an island surrounded by the river Okeanos. To regard it as resting on the water is a further step towards a truer view. It was something to get the earth afloat. This was no doubt connected with what Aristotle regards as the principal tenet of Thales, namely, that everything is made out of water, or, as he puts it in his own terminology, that water is the material cause of all things."[18]

Among the modern scholars, Cornford[19] expresses doubt about this aspect of Aristotle's version of the view of Thales. As he observes, "Misled by Aristotle's habit of regarding his predecessors as more or less imperfectly anticipating one or more of his own four causes (material, formal, moving and final), the older historians of philosophy accepted his view that the early Ionians were concerned only with 'principles of a material kind', such as water or air. Accordingly, they were represented as putting to themselves the question, what is the one (material) substance of which all things consist? But, if we look at the systems themselves, the question they answer is a different one : how did a manifold and ordered world arise out of the primitive state of things ?"

In default of any actual writing—or even of any authentic statement of Thales surviving for us, it is evidently impossible today to be sure if he knew the distinction between the material substance of which all things consist and the ultimate or primitive state of things from which the manifold and ordered world arises. This much is obvious, however, that the profound importance generally imputed to him in the histories of science is because of his view of water—a natural principle—being the ultimate stuff of everything in nature. Evidently, the importance of the view itself

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18. Burnet i. 20.

19. F.M. Cornford, *Principium Sapientiae*, Cambridge 1952, 159.

is not to be judged by the standard of contemporary knowledge, but in the general historical setting to which Thales belongs. Or, as Burnet[20] rightly comments, "His greatness, however, would lie in his having asked the question rather than in the particular answer he gave it."

Still the question remains : What could it be that led him to such an answer? "We have", observes Burnet, "no trustworthy information about the grounds on which this doctrine was based ; for, in the absence of any writings by Thales himself, Aristotle can only guess, and his guesses are apparently suggested by the arguments used in support of a similar theory at a later date."[21] Another possibility is suggested by Benjamin Farrington in his *Greek Science* : "The great renown of Thales, however, rests not on his geometry or his turn for affairs, but on a new commonsense way of looking at the world of things. The Egyptians and Babylonians had old cosmogonies, part of their religious inheritance, which told how the world had come to be. Since in both countries, in cold fact, the land on which they lived had been won in a desperate struggle with nature by draining the swamps beside their rivers, naturally enough their cosmogonies embodied the idea that there was too much water about, and that the beginning of things, in any sense that mattered to men, was when some divine being did the equivalent of saying, *Let the dry land appear*. The name of the Babylonian creator was Marduk. In one of the Babylonian legends it says : 'All the lands were sea. . . Marduk bound a rush mat upon the face of the waters, he made dirt and piled it beside the rush mat.' What Thales did was to leave Marduk out. He, too, said that everything was once water. But he thought that earth and everything else had been formed out of water by a natural process, like the silting up of the delta of the Nile. . . It is an admirable beginning, the whole point of which is that it gathers together into a coherent picture a number of observed facts *without letting Marduk in*".[22]

What Farrington is driving at is said by Brunet and Mieli in more general terms whom therefore Farrington quotes with approval : "These philosophers [i.e. Thales and his close followers] are, according to the accurate title given to them in antiquity, *physiologoi*, that is to say, observers of nature... They observe the phenomena which present themselves to their eyes, and putting aside all supernatural or mystical intervention, they endeavour to give strictly natural explanations of them. It is in this sense, and their rejection of all magical intervention, that they make the decisive step towards science and mark the beginning, at least the conscious and systematic beginning, of a positive method applied to the interpretation of the facts of nature."[23]

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[20] Burnet i. 21.

[21] *Ibid*.

[22] Farrington 36-37. Emphasis added.

3. PRELIMINARY OBSERVATIONS ON UDDALAKA

We have briefly mentioned what is basically known about Thales and some comments on his possible intellectual achievements mainly for one reason. It is to compare him with Uddalaka. The need for such a comparison is obvious, because we are going to show that Uddalaka has a far stronger claim than Thales to be recognised as the first conscious nature-scientist in global history.

Lest, however, our claim may appear as outrageous to the commonly accepted notion of the history of science, we may begin with certain salient points of his teachings.

1. He presumably belongs to a period earlier than that of Thales or is at least a senior contemporary of him.

2. Thales, leaving as he does nothing for us in writing, the modern scholars are left only with more or less plausible conjectures about the way he reaches the view of water being the original stuff of which everything in nature is made. By contrast we have very positive and authentic data not only concering the conclusions reached by Uddalaka but also about his mode of procedure or the methodology followed by him. Thus :

(a) Without bluntly rejecting the earlier scriptures embodying mythological beliefs and magical injunctions, Uddalaka very cleverly dismisses all these in favour of a rational search for the ultimate cause of everything in nature, recommending practically at every step to seek guidance from direct observation—observation in the real and the most indisputable sense. Compared to Thales, this procedure must have been all the more daring for him, because the creator-god Marduk, whom Thales is supposed to have scrapped, belongs to the belief-system of the Babylonians after all, while Uddalaka has *de facto* to ignore what is already sanctified in his own immediate intellectual context as having the highest scriptural authority.

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[23] Quoted by Farrington 41.

(b) In search of the ultimate cause of everything, the first point Uddalaka wants to be clear about is the concept of causality itself—a point which, for all that we know, never occurs to Thales, or for that matter to any other thinker preceding him in the European tradition.

(c) Clarifying, thus, the concept of causality, Uddalaka passes on the mention what he wants to understand as the first cause. However, instead of specifying this as matter in any gross form like water or air, Uddalaka goes deeper and invents a new category for it. He calls it Pure Being—in Sanskrit, *Sat*—meaning, as we shall see, Matter in its pre-evolved form of the manifold world.

(d) He next proceeds to explain how the multiplicity of phenomena *evolves* from this ultimate cause—the primeval matter or Pure Being. This is done in two stages. To begin with, he wants to show how from this there successively evolve three primary elements, which he calls heat (*tejas*), water and food. In other words, from the primeval undifferentiated Pure Matter first evolves heat, from heat water and from water food. Judging Uddalaka's view in its actual historical context—which requires us to move back to the eighth or seventh century B.C.—what appears to be most remarkable about this process of evolution outlined is at least two points. First, he gives the definite impression that what he is talking of is not the result of bare speculation or imagination. On the contrary, it is based on definite observations. Secondly, he refers in his own way to what we call these days the interpenetration or interaction of elements in everything that exists in nature.

Thus, the *tejas*—ordinarily translated as heat—exists for him nowhere as mere heat or heat pure and simple. It is called heat because of the *predominance* of the heat-element in certain things, whereas in fact the same things also contain or are interwoven with a certain amount of water and food. So also are the cases of water and food of which the other things are predominantly made of.

Thus arriving at the principles of heat, water and food, Uddalaka proceeds to explain the evolution of everything in the world from these principles, depending in his own way on the evidence of *observation of facts.* We propose to put special emphasis on Uddalaka's zeal for wanting to substantiate practically every point in his view with some definite evidence of observation, because it is something unique about the beginning of science in its global overview.

On this point, we cannot help contrasting Uddalaka specially with Thales, whose cosmological ideas fascinate the historians of science so much. How far Thales himself at all depends on observation of nature for arriving at the conclusion of a natural substance—water—being the ultimate cause or primitive principle of everything in nature is not definitely known. Some modern scholars may at best conjecture that Thales presumably depends on observation in some form or other. But notwithstanding such conjectures the basic fact remains that *how* Thales arrives at his conclusion is not known to us with any certainty.

The case of Uddalaka, however, is entirely different. The information we have of him—the authenticity of which, as we shall presently see, is beyond the scope of any possible doubt—leaves us with no uncertainty or vagueness about his procedure. An outstanding feature of this procedure is his dependence on the observation of facts on which he repeatedly, almost obsessively, relies.

But not simple observation. From the procedural point of view, what is much more important about him—and which in the history of global science appears to be simply stupendous—is that Uddalaka Aruni is assuredly the first scientist who uses the *method of experimental verification* in support of his conclusion. Pending a more detailed discussion of the textual material on which this point is based, we can very briefly mention here the nature of this experimental verification.

While wanting to show how everything in nature originates from heat, water and food, one of the main problems he specially concentrates on is that of the making of man. In this connection, he claims that "life" (*prana*) in the human beings is the product of "the finest essence of water", while "mind" (*manah*) is the product of "the finest essence of food." However, averse as he is merely to declare the view, he is keen on *proving* it. But how to prove that "life" consists of water and "mind" of food ? For this purpose, he goes in for an *experimental demons-*

tration. He asks his son—who had already memorized for twelve years what was then considered the Vedas—to spend fifteen days without eating any food, drinking only water, so that "life"—which is made of water—can remain, i.e. the son can be free from the danger of death.

The son lives for fifteen days only on water. Then he returns to Uddalaka, who wants the son to recite the Vedas. The son replies that nothing occurs to him, or in the ancient way of putting it, he has lost his "mind". So Uddalaka asks the son to go back, eat food for fifteen days and then return. When the son does it—having eaten food for the next fifteen days—and returns to Uddalaka, he is asked again to recite the Vedas. This time the son does it satisfactorily, i.e. according to the ancient way of putting it, his "mind" comes back or is recreated from the food consumed. Thus is *experimentally demonstrated* that it is food which goes to the making of the "mind".

Rudimentary though it may appear in contemporary standard such a view of the making of mind, there is no doubt that in the whole history of global science, the procedure of *proving a view on the strength of experimental method* is something absolutely new, i.e. as far as it is possible on the basis of unaided sense-organs and under conditions incompletely controlled. Uddalaka nevertheless is the first in human history to feel the need of the method of proving something with the aid of a planned experiment. If for no other reason, because of this methodology alone we have to look back at him as the first in world history who opens the door of natural science. But we shall see that there are many more considerations wanting us to take such a view. Thus, for example, he is the first to attempt a comprehensive and naturalistic explanation of the evolution of the world with special emphasis on the making of man and, as we shall see, presumably also to foreshadow the molecular theory and even the atomic hypothesis. So also are various other features in his views having positive significance from the standpoint of natural science.

In short, therefore, we have to amend—and even reject—the widely prevalent view of Thales having been the first scientist and accept instead that this glory goes to Uddalaka.

Only after substantiating this point, we shall be able to take up two other questions. First, how much of impact this scientist has in the history of his own country? Secondly, what is the relevance for the scientific community of the world today of his contributions to natural science?

But an analysis of his discourse first.

4. THE DIALECTICS OF SCRIPTURAL SANCTION

The main source of our information regarding Uddalaka Aruni are the *Upanisad*-s, particularly one chapter of the *Chandogya Upanisad* exclusively recording his discourse, though this needs to be supplemented by some passages from still earlier sources like the *Satapatha Brahmana*.

It needs at once to be noted that this circumstance obliging us to depend mainly on the *Upanisad*-s and the *Brahmana*-s for an understanding of Uddalaka's actual position creates a peculiar advantage as well as the most formidable difficulties. Vedic orthodoxy wants us to believe that the *Upanisad*-s formed appendices to the *Brahmana*-s and the entire corpus of the *Brahmana-Upanisad* literature formed part of the Vedas and was hence invested with the highest scriptural authority. Ancient Indian law-codes as embodied in the Dharmasastra, being the creation of the priest class after all, naturally decreed that the Vedas—i.e. inclusive of the *Brahmana-Upanisad* texts—were but direct revelations (*sruti*) and hence enjoyed scriptural authority. The grave difficulty created by this for any objective understanding of the actual contents of this literature has been noted by some eminent Vedic scholars which we shall ourselves have to reiterate for our discussion. That which remains unnoted and unemphasized, however, is that there was also another aspect of the situation which amounts in fact to be of peculiar advantage for the historians. Viewed as scriptural declarations after all, the texts are supposed to be absolutely inviolable and unalterable. While retaining these in memory—and committing these to writing in a much later period—the least liberty taken even in the matter of a single word is thus inconceivable. As for Uddalaka therefore, the views he is supposed to have preached and the expressions he is supposed to have used for the purpose come down to us with a meticulous fidelity of their own. These retain the exact form in which they were preached already in the eighth or seventh century B.C. i.e.

the period in which serious Vedic scholarship wants us to place these texts.

Such an accurate preservation of the actual view of a thinker as ancient as Uddalaka appears indeed as nothing short of a wonder. Comparing his case particularly to that of Thales—which for obvious reasons we have repeatedly to do for settling the claim of his being the first scientist in global history—it would be an error therefore to ignore the peculiar advantage of our source of knowledge about Uddalaka's views. In the case of Thales, even after laboriously moving through all sorts of legends about him once current in ancient Greece it is difficult for the historian of science to be exact about the reasons for his great fame. But such a difficulty is not there about Uddalaka. Whatever he might have preached so many centuries before our time, survives for us word for word and this because the *Brahmana*-s and *Upanisad*-s were sanctified as scriptures by those who belonged to the circle of Vedic elites.

Such then, is the advantage of the texts having been invested with scriptural authority. At the same time this investment of scriptural authority is infested with an inner contradiction. It also creates the most formidable difficulties for an objective understanding of his actual view. The *Upanisad*-s, once accepted as nothing short of scriptural declarations there naturally grew the tendency of rejecting outright the possibility of these containing any inner discrepancy. The minimum that is required of the scriptures is a uniform understanding of man and the universe. A scripture expounding incompatible ideas and attitudes is nothing short of a misnomer. Growing therefore out of the claim of the *Upanisad*-s having been scriptures there developed the inevitable zeal to bring Uddalaka's teachings in complete conformity with some form of mystical idealism that found favour in the royal courts of Upanisadic India—a view according to which the Pure Spirit transcending all possible modes of our mundane descriptions is the only reality. By far the most renowed representative of such a view was a certain Yajnavalkya. One of the major *Upanisad*-s, the *Brhadaranyaka*, seems to take special pride in describing how much of financial support and political patronage was extended to him by the royal patron of philosophy of the age. Such a view, seriously taken, cannot but show the tendency of reducing nature as a whole to a phantom of imagination. It is no wonder that this Yajnavalkya declares that as you fall into deep dreamless sleep, you have some kind of realisation of the ultimate truth, maybe without being aware of it.[24] The reason for such an extra-ordinary assertion is not far to seek. As one sinks into the state of the deep dreamless sleep, one is no longer obsessed with the sense of the material world or nature and is left only with the Pure Soul though without being aware that this Pure Soul itself is exclusively real. Another renowed philosopher Sanatkumara puts the point by way of asserting that complete introversion or the total withdrawal of interest from nature to the Pure Self itself is the ultimate goal of reality. As he explains this goal : *atmarati atmakrda atmamaithuna atmananda*—the libido fixed on the self, sporting with the self, copulating with the self, finding delight in the self.[25]

We have mentioned all this only to illustrate one point. Such is the essence of the officially boosted philosophy of the *Upanisad*-s and its main drift is the total denial of the reality of nature. Stifle all curiosity about nature, scrap totally the value of the observation of phenomena and cultivate the make-belief that the soul in its purity is the only reality and hence its knowledge alone is worth striving after. Therefore, admitting what we must, that natural science is motivated by the main purpose of probing deeper and deeper into nature with its infinite variety and multiplicity of phenomena the essential drift of such a philosophy can only be described as anti-science[26]; the only function of science is chasing the phantoms produced by perverse imagination or more simply by ignorance. But the understanding of nature is precisely what Uddalaka strives after according to the Upanisadic records themselves. We have already mentioned some salient points of his teachings and we are going to see in textual details, he is nothing short of a single-minded person wanting to understand man and nature, taking these as objects of any worthwhile pursuit, depending at every step on the direct observation of phenomena.

Here therefore Vedic orthodoxy is confronted with a formidable problem. While the officially boosted philosophy in the *Upa-*

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[24] *Br. Up.* iv.3.21f.

[25] *Ch. Up.* vii. 25. 2.

[26] This is declared in so many words by Sanatkumara in *Ch. Up.* vii. 1.3-4.

nisad-s insists on explaining nature away, Uddalaka is interested above all in explaining it. Could it, thus, be that the Upanisadic texts do embody opposite and contradictory ideas and attitudes? However, once these texts are declared to have scriptural status, such a possibility has to be ruled out at any cost, for it is absurd to imagine that the scriptures contain such a blatant contradiction as preaching the damnation of science as well as its opposite, namely a very pronounced enthusiasm for nature science.

Such then is "the dialectics of scriptural sanction" claimed for the Upanisadic texts. On the one hand, it meticulously retains Uddalaka's views, while, on the other hand, it shows how blatantly it goes against the view which Vedic orthodoxy claims to represent as the Upanisadic wisdom *par excellence*. The situation taken as a whole thus represents a flat contradiction. Evidently the simple way of resolving the contradiction is to scrap the claim that the *Upanisad*-s do not as a matter of fact contain a uniform view, that these are but compilations of a number of alternative attempts to understand man and the world—the characteristic peculiarity of the intellectual climate of the period. Such is actually the stand taken by a number of modern scholars[27] who are also lifelong students of the Vedic literature. But Vedic orthodoxy will have nothing to do about such a stand. Doubt in any form—overt or otherwise—of the scriptural status of the *Upanisad*-s means a shipwreck of this orthodoxy itself.

What then would the Vedic orthodoxy do when confronted with a natural scientist as astute as Uddalaka Aruni in the *Upanisad*-s themselves? The only alternative left for it is to interpret Uddalaka's teachings in such a way that these may be brought in conformity with the view officially sanctified as *the philosophy* of the *Upanisad*-s. As a matter of fact, the representatives of Vedic orthodoxy appear to make the most determined effort to do this. It remains for us to see that the arguments used for the purpose range from the fanciful to the ridiculous.

5. A SENIOR CONTEMPORARY OF THALES OF MILETUS

We shall begin with a few words on the possible date of Uddalaka, so that we can place him—roughly though—in his actual historical context.

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[27] Bhandarkar 1; Thibaut in SBE xxxiv. Intro. ciii; R.E. Hume TPU 7; Gaden in ERE xii. 541; Barua 51-187 etc.

In default of any direct mention anywhere of his date, the only alternative we are left with is to presume it from the possible date of the literature that forms the main source of our information about him.

As a thinker Uddalaka figures prominently in the *Chandogya Upanisad*. But some other principal *Upanisad*-s are also aware of him. What, then, could be the date of the *Upanisad*-s? Scholars specializing in these texts are on the whole agreed that the major *Upanisad*-s like the *Chandogya* must have been earlier than the Buddha, who died at about the age of 80 a few years before or after 485 B.C., but who, according to the Buddhist tradition, started preaching his own views contesting some dominant Upanisadic ones already in his early youth. From this, one is naturally inclined to infer that such major *Upanisad*-s were already current in the sixth century B.C. Therefore, assuming Uddalaka's date could have been the same as that of the *Upanisad*-s, he must have roughly been a contemporary of Thales. But such an assumption itself is exposed to some doubt. R.G. Bhandarkar,[28] along with some scholars whose authority cannot be easily questioned, have argued that the form in which the *Upanisad*-s reach us are of the nature of compilations of legends and theories already in circulation from an earlier period. This means, Uddalaka could have lived and preached before the *Upanisad*-s assumed their present form. As a matter of fact, we have positive evidence in favour of such a possibility. The *Satapatha Brahmana* mentions him as a person of considerable wisdom. According to the competent Vedic scholars, this text could by no means be later than the eighth or seventh century B.C. This, along with the consideration that the *Satapatha Brahmana* does not necessarily record only contemporary events, adds to the possibility of Uddalaka having been earlier than Thales.

Little is known, of course, about his personal life. The *Upanisad*-s consider him as the son of a certain Aruna, accounting thus for his surname Aruni. He is often also mentioned as Gautama, presumably by his clan-name. The early Buddhist literature, however, contains 550 stories, called *Jataka*-s, which the orthodox Buddhists want us to believe as accounts of the Buddha's "former births". As some of these stories are sculptured in the carvings on the railings round the ancient relic-shrines of Sanchi, Amaravati and Bharut, the inference is that these were widely known in the third century B.C., though the stories themselves are likely to have been much earlier. One of these bears the name *Uddalaka Jataka* (No. 487). Though the authenticity or otherwise of the legend about Uddalaka embodied in it can neither be proved nor difinitely disproved, if one dares to take the risk of salvaging something real about Uddalaka from this story, one may as well have some idea about his personal life. First, the name Uddalaka is—according to it—derived from the circumstance of his birth : his father—mentioned without any proper name as a chaplain of the king of Benares—mated with a slave-girl under an Uddala tree (*cassia Fistula*). Secondly, on growing up, Uddalaka goes to Taxila to study under a world-renowned teacher there, though he himself soon becomes highly learned and the leader of a group of roving ascetics. But he first joins the band for the sake of learning from them, agreeing for the purpose to please them by doing their menial work. Thirdly, he shows scant respect for the nobility of other castes. What matters for him instead is knowledge and purity.

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[28] See above *n* 27.

It is of course precarious to attempt any reconstruction of Uddalaka's life from a *Jataka* story. What nevertheless is intriguing is the reference to Taxila where he goes for his early education. Besides being a very famous centre of secular learning in ancient Asia, it was then the meeting point of many important trade-routes and hence also had a rather cosmopolitan intellectual climate very different from that of the areas under the influence of Brahmanical orthodoxy. As a result, the Brahmanical lawmakers consider Taxila as an impure place.

Could it, thus, be that Uddalaka's turning away from the spiritualist-idealist philosophy—a philosophy highly boosted by the orthodox lawmakers—or his enthusiasm to develop an essentially secular view first foreshadowing natural science and the scientific method systematically, is somehow influenced by the general intellectual climate of the north-western region of the present-day Indo-Pakistan cultural frontier, which was outside the domination of the Brahmanical orthodoxy so hostile to the scientific temper ?

It may be hasty to attempt any categorical answer to the question concerning Uddalaka's connection with Taxila. The historical data in our possession are scanty after all. Still we have some definite hints in the *Upanisad*-s and *Brahmana*-s which make us hesitate to discard such a possibility as *prima facie* absurd. Here are some of these.

Uddalaka is about the only thinker in the entire corpus of the major *Upanisad*-s to have mentioned Gandhara or the Taxila region, apparently adding that a person from there is to be considered as a learned one.[29] Elsewhere, in the *Brhadaranyaka Upanisad*[30] he clearly says that he stayed among the Madra-s, studying there. Modern scholars identify the ancient country of the Madra-s with present-day Sialkot, which therefore is not far from ancient Taxila, included within the same cultural zone to which Taxila belongs.

Another interesting evidence in this connection comes from the *Satapatha Brahmana*. Besides connecting Uddalaka's educational career with the northern region outside the stronghold of Brahmanical orthodoxy, it shows his actual bent of mind, indicating his eagerness to acquire scientific knowledge, with scant respect for the caste-status of the person from whom this could be obtained.

However, before quoting this from the *Satapatha Brahmana*, we may as well have some preliminary clarifications. As is only to be expected from the general nature of the *Brahmana*-texts, which are anxious above all to validate certain ritual trivialities, the evidence we are referring to remains wrapped up with a good deal of mystification, which we have to scale off for arriving at its rational core. This done, the legend stands as follows :[31]

Uddalaka Aruni once drove about in the northern country. According to the prevalent practice of the time, he offered a piece of gold as a challenge to the local people to contest him in disputation—something like what we call a bet these days. This created panic among the people there, who said among themselves :

> "This fellow is a Kuru-Pancala Brahmin and son of a Brahmin—let us take care lest he should deprive us of our domain : come, let us challenge him to a disputation' (said the northern people among themselves).
> —'With whom for our champion ?'

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[29] *Ch. Up.* vi. 14. 1-2, cf. Barua 125.

[30] *Br. Up.* iii. 7. 1.

[31] *Sat. Br.* xi. 4. 1. 1-9.

—'With Svaidayana'. Svaidayana, to wit, was Saunaka.

They said, 'Svaidayana, with thee as our champion we will fight this fellow.'

He said, 'Well, then, stay ye here quietly : I will just find out what kind of man he is'.

He went up to him, and when he had come up, he (Uddalaka) greeted him saying, 'Svaidayana !'

'Hallo, son of Gautama,' replied the other, and straightway began to question him.

'He alone, O son of Gautama, may drive about amongst people as a champion, who knows... whereby it is that creatures here are born toothless, whereby they (the teeth) grow with them ; whereby they decay with them, whereby they come to remain permanently with them ; whereby in the last stage of life, they all decay again with them ; whereby the lower ones grow first, then the upper ones ; whereby the lower ones are smaller and the upper ones broader ; whereby the incisors are larger and whereby the molars are of equal size.

'He alone, O son of Gautama, may drive about amongst people as a champion who knows...whereby creatures here are born with hair ; whereby for the second time, as it were, the hair of the beard and the arm-pits and other parts of the body grow on them ; whereby it is on the head that one first becomes grey, and then, again, in the last stage of life, one becomes grey all over.

'He alone, O son of Gautama, may drive about amongst people as a champion who knows...whereby the seed of the boy is not productive, whereby in the middle age it is productive, and whereby again in his last stage of life it is not productive.'...

Then he (Uddalaka) gave up to him the piece of gold saying, 'Thou art learned, Svaidayana ; and verily gold is given unto him who knows gold.' ....

He (Uddalaka) then came back to him, with fire-wood in his hand, and said, 'I want to become thy pupil.'

—'What wouldst thou study ?'

—'Even those questions which thou didst ask me—explain them to me'.

Lest the profound significance of the entire passage from the viewpoint of the history of science is inadequately appreciated, we may as well try to be clear here about one point. Superficially viewed, the passage as a whole may appear to be but a body of mere observation, showing at best a rather uncommon interest in the phenomena observed. But such a view of the passage may make us miss its real scientific significance. What it embodies is a distinct *zeal for understanding the phenomena* observed—the spirit of raising the question concerning the *why* and *how* of the bodily changes observed. It is precisely this spirit that creates conditions for scientific quest. As my colleague Dr. Partha Ghosh is fond of frequently saying: After all the fact remains that thousands and thousands of people have gone on observing that the apple falls to the ground, but only when Newton raised the question concerning the why and how of this, conditions were created for the most momentous step being taken to science. The passage quoted from the *Satapatha Brahmana* shows in its own way the same spirit. It is not just a bundle of rather remarkable observations but much more than merely so. What dominates the entire passage is the spirit of enquiry—the question concerning the *why* and *how* of a number of peculiar changes in the human body which might have been open to the inspection of many. But nowhere before the *Satapatha Brahmana* do we come across the zeal for raising the question concerning their cause. And it is evident from the passage itself that it is this spirit of enquiry that immediately draws Uddalaka, indicating thereby his scientific bent of mind. Not that Uddalaka himself raises this question concerning the why and how of the phenomena observed. What is so striking about him is that when he is made to confront the question, he forgets everything about his own background—the pride of coming from the circle of Kuru-Pancala elites—and rushes to become a pupil of one who somehow has the intellectual courage to raise such questions.

But let us return to the passage itself.

It may be more than mere coincidence that the name Saunaka figures prominently as a medical authority in the grand compilation called the *Caraka-samhita*.[32] But it is surely important to note that the questions he raises are of definite physiological and anatomical interest.

Not that we expect anybody of that age to know the real answers to these questions, and for that matter it may be embarassing to ask ourselves if full answers to the questions are known even to us. Nor do we expect the compilers of the *Satapatha Brahmana* to record objectively the answers to the questions as far as these can be offered roughly in the eighth or seventh century B.C. Interested above all in mystery-mongering about the priestly rituals, our text makes Saunaka answer these

[32] *Caraka-Samhita* i.1.8.

questions mainly in terms of what Max Muller aptly describes as mere "theological tawddles".

What nevertheless appears stupendous is the nature of the questions themselves. Never before in human history such questions have been raised at all. No less remarkable for our present discussion is Uddalaka's eagerness to learn about all this, in spite of being already famous for his own wisdom—an eagerness going to the extent of begging to be a student of one belonging, from the standpoint of Brahmanical arrogance, to a rather despised area. Apparently, the quest for scientific knowledge leads Uddalaka to ignore the Brahmanical claim of being the exclusive custodian of real wisdom. Apparently, again, such a legend implicitly derogatory to the main centres of Brahmanical culture—the so-called Aryavarta—would not have found place in the *Brahmana* literature but for the fact that Uddalaka Aruni's fame had already become too important to be overlooked or ignored in the ancient period.

It may not be irrelevant to quote here an observation of B.M. Barua in which he wants to emphasise Uddalaka's zeal for knowing as an index to his scientific temper. Uddalaka had the humility to learn from anybody, irrespective of his caste or creed. As Barua observes :

"All the existing records, whether Brahmanical or not in origin, speak of Uddalaka as a life-long student : One who was old in years, but never too old to learn. This would seem to be true, because the verdict is so unanimous. He was an earnest seeker of truth, and an intense lover of wisdom. He sought after truth without stopping for a moment to consider from whom he might learn it. His conduct, in this respect, was in harmony with his philosophy. By his personal example he tried to establish a commonwealth of thought and culture, which admitted of no distinction of age or colour."[33]

In substantiation of this observation, Barua mentions a number of evidences of the *Upanisad*-s, according to which Uddalaka does not hesitate to approach anybody expounding a view about which he himself has no idea. Interestingly enough, such views include about the "soul" and its future after death. Though Uddalaka has the patience to listen to these, we shall presently

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33. Barua 129.

see that the *Upanisad*-s nowhere indicate that the views themselves make any dent on his own. But the more significant point is suggested by the *Uddalaka Jataka* : he agrees to do menial service to the band of ascetics at Taxila, with the hope of learning something worthwhile from them. Presently, the ascetics have nothing worthwhile to teach him and they soon accept Uddalaka as their leader.

It will possibly be objected that all this is legend after all, and hence what we may glean from these about Uddalaka can have practically no historical value. However, it seems to be our misfortune that while discussing the pioneers of natural science, we are obliged to depend more on legendary material than any definite historical evidence.

How much of historical truth, for example, is there on the basis of which most of the historians of science want us to accept Thales of Miletus as the first scientist in global history? There primarily are all sorts of legendary materials about him, often even in open conflict with each other. The legends about Uddalaka are at least less chaotic. Even the authenticity of the view—namely, water is the ultimate material cause of the world—mainly on the strength of which Thales is usually considered the first scientist, is questioned by a scholar like Cornford, and this in spite of Aristotle's authority.

Here, however, is a point on which our knowledge of Uddalaka is based on sounder data. Instead of any stray statement of some later writer, we have in the *Upanisad*-s in particular a long and coherent record of Uddalaka's view systematically expounded. Other reference to him are fully in conformity with this. We have already seen why any possibility of this discourse being later inserted into the *Upanisad*-s is ruled out by the very nature of these sources.

6. FROM PRE-SCIENCE TO SCIENCE

It is argued that Thales requires to be recognized as the first scientist because of the fact that he scraps earlier mythology in order to make room for a natural substance to be recognized as the ultimate cause of everything. This, it is claimed, is the first and hence the most momentous step from pre-science to science. Our question, therefore, is : how does Uddalaka's position bear comparison with this?

The longest account of Uddalaka Aruni is preserved for us in the form of an isolated but self-sufficient chapter in the *Chandogya Upanisad*. Significantly enough, it begins with the same—or at least a closely similar—step being taken by him, though, as is only to be expected, he does it in his own way, which means that it is expressed in our text in terms appropriate for its time.

During Uddalaka's time, the Vedas—by which are obviously meant the early *Samhita*-s, like the *Rgveda-samhita*—had already acquired scriptural status, and hence as repositories of the highest wisdom. The study of these is thus a precondition for being qualified to belong to the circle of the elites, which the Brahmins call as being a "true" Brahmin. Uddalaka does not, of course, challenge the authority of the Vedas in so many words. Nor does he propose to overtly reject the prevalent practice of being entitled to belong to the circle of the elites. Anything like that entails in his immediate context the risk of being branded as an abject heretic. His account, as preserved in the *Chandogya Upanisad*, thus begins at least with an apparent impression of tacitly accepting all this. This has the further advantage of contrasting his *real* attitude with the implicit acceptance of the scriptural lore—an attitude which, as we are going presently to see, is that the study of the scriptures is redundant for the quest that matters above all to him. It is an essentially secular and rational quest of the ultimate principle or fundamental stuff from which everything in the universe evolves. In other words, what he wants to show at the very first step of his discussion is that the orthodox prescription of a prolonged study of the scriptures leaves one ignorant about things that really matter. He shows that a different method altogether is required for the purpose.

Here is how his account begins in the *Chandogya Upanisad* (Chapter vi):

Once upon a time there lived Svetaketu, the son of Uddalaka. According to the practice of those days, when he was twelve years old, the father sent him for a thorough study of the Vedic lore. Having studied the Vedas for twelve years under some competent preceptors, Svetaketu returns home at the age of twenty-four—conceited and proud of his learning.

Uddalaka asks him, 'Svetaketu, my dear, you are conceited and proud of your learning. But did you also ask (your preceptors) about that teaching by which what has not been heard of [? in bare scriptural lores] becomes heard of, what has not been thought of becomes thought of, what has not been understood becomes understood ?'

The son fails to follow what his father is talking about, and this in spite of his thorough study of the scriptures for full twelve years. Evidently, this is not because of his failure to learn, but, as the text presently says in so many words, his preceptors themselves had no idea of what Uddalaka is questioning about. In any case, he requests the father to be clearer about the question itself. The father clarifies that what he is talking of is the ultimate stuff of which everything in the universe is made. According to the Upanisadic way of putting it, Uddalaka first wants to clarify his question with a series of commonplace examples of observation :

> 'Just as, my dear, by knowing one piece of clay, everything made of clay may be known—the modifications (in the form of the varieties of the clay-objects) are mere matters of verbal distinction or simply names ; the reality is just clay.
>
> 'Just as, my dear, by knowing one piece of gold, everything made of gold is known—the modifications (in the form of golden objects) are mere matters of verbal distinction or simply names ; the reality is just gold.
>
> 'Just as, my dear, by knowing one nail-cutter, everything made of iron may be known ; the modifications (in the from of all iron-objects) are mere matters of verbal distinction or simply names ; the reality is just iron.
>
> So, my dear, is the teaching.'
>
> Svetaketu says, 'Verily these learned men (that taught me the scriptural lore) have no notion of this ; for if they had known it, why would they have not told me ? So do you, sir, tell me it.'

Uddalaka agrees to do so.

One point, however is in need of immediate clarification. It is concerning Uddalaka's use of the word *namadheya* (*Ch. Up.* vi.1.4) implying that the modification of the fundamental stuff in the form of all individual objects is but apparent. This is intended to prove the basic reality of the fundamental stuff itself. The underlying attitude must not be confused with the one expressed by an extreme idealist, viz. Sanatkumara, who also uses a closely similar expression, namely, *nama eva*, (*Ch. Up.* vii.1.3) to indicate the abject futility of all branches of study then cultivated. While Uddalaka's emphasis is on the importance of understanding the basic material that goes to the making of the multiplicity of its products, Sanatkumara's emphasis is, really speaking, on the futility of learning as such, inclusive of what can be characterized as proto-science in the Upanisadic context. The similarity of expression notwithstanding, therefore, there is indeed a world of difference between the two approaches.

Before proceeding further, we may have clarification about a few more points. What could possibly be the significance of such a preamble for expounding Uddalaka's views? There can be only one answer to it. It is intended to show that the conceit or pride of mastering the scriptural lore is vain and meaningless from Uddalaka's viewpoint. The question that is all-important for him is that of the ultimate stuff underlying the multiplicity of the world. But even the profoundest mastery of the scriptures has no light to throw on it. On the contrary, a few familiar facts of observation are much more significant for the purpose of realizing that, behind the bewildering variety of phenomena in nature, there must be some ultimate stuff which alone is real and the search for such a stuff is much more significant than the mass of scriptural knowledge.

Is it not a way of rejecting the authority of the scriptures, though done in an extremely crafty manner? When any blunt rejection of the scriptures would undoubtedly pass as a mark of abject heresy, leaving scientific quest simply buried under the heap of abuses, Uddalaka knows the trick of evading the censorship of orthodoxy, and this by first sending his son for a full course of scriptural studies. Only *after* this, he shows that such a study is no good for the knowledge really worth striving after. This is indeed a very intelligent way of rejecting the religio-mythological view of things without being rejected as one not worth listening to at all.

Thus, like that of Thales, Uddalaka's search for the first cause, too, virtually amounts to the rejection of the older mythological-religious view of things, though—compared to Thales—his is a much more difficult task. For Thales, as we have already noted, the water-god Marduk, whom he is said to reject in favour of water as a natural phenomenon is an *alien god* after all—a god of the Babylonians. However what Uddalaka has to ignore or undermine in his own quest is already sanctified as scriptural wisdom or the most holy knowledge in his own immediate context. From this point of view, his adventure of ideas must have been more daring than that of Thales. But the account of Uddalaka's view does not stop here. What follows enables us to see how very systematic his procedure is, compared to which what we know of Thales appears to be somewhat trifling.

Before proceeding to discuss Uddalaka's procedure, we may as well add here another point to show how strongly he goes even against the most pronounced tendency of the other Upanisadic thinkers. Thus while his contemporaries were most keen on proving the *magical* efficacy of the 'secret knowledge' (the literal meaning of the word *upanisad*), Uddalaka himself nowhere even hints at such a suggestion. Referring to the basic trend of the Upanisadic claim, Hume observes, "Knowledge was the one object of supreme value, the irresistible means of obtaining one's aims. This idea of the worth and efficacy of knowledge is expressed again and again throughout the Upanisads not only in connection with philosophical speculation, but also in the practical affairs of life...... so frequent are the statements describing the invulnerability and omnipotence of him who is possessed of this magic talisman, that *ya evam veda*—'he who knows this'—becomes the most frequently recurring phrase in the Upanisad."[34]

But this efficacy of knowledge is not to be misunderstood. It is supposed to be something essentially magical. The typical Upanisadic way of expressing such magical belief is 'one who knows this reaches a full length of life, lives long, becomes great in offspring, great in cattle, great in fame.' Not that magical belief is something peculiar to the vast majority of the Upanisadic thinkers. In fact, the *Yajurveda* and the *Brahmana*-s are full of it. In these, however, the magical potency is attributed to the ritual acts. In the Upanisads, by contrast, the belief is displaced. It is now the belief in the magical efficacy of the secret wisdom itself. But Uddalaka is about the only eminent thinker of the age in whose view such a belief is most conspicuously absent. There is no mumbo-jumbo at all about the magical potency of the knowledge he preaches. It is on the contrary essentially a rational knowledge based on observation and even experiment. From this point of view one is tempted to comment that where the scriptural studies end, his own study takes it start.

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[34] R.E. Hume 58-59.

7. THE CONCEPT OF CAUSALITY

In quest of the ultimate cause of things, it is evidently necessary first of all to be clear about the concept of causality itself. According to the *Chandogya Upanisad*, the next step taken by Uddalaka is intended to do it. Here, again, he has to go against a view sanctified by the scriptural authority. Thus his instruction continues :

> In the beginning, my dear, this world was just Being (*sat*), one only, without a second. To be sure, some people say, 'In the beginning this world was just Non-being (*a-sat*), one only, without a second ; from that Non-being was produced Being.'
>
> 'But, verily, my dear, whence could this be ?' he said, 'how from Non-being could Being be produced ? On the contrary, my dear, in the beginning this world was just Being, one only, without a second.'

Evidently we are confronted here with a controversy concerning the nature of causality : Can Non-being or nothingness be ever the cause of anything, or, are we obliged to view everything as being produced by something already existing, some 'Being' ?

It is well-known that in later Indian philosophy there is a good deal of controversy between two views of causality, technically called *asat-karya-vada* and *sat-karya-vada*. The former claims that the effect is a new beginning altogether, while according to the latter, the effect is already potentially contained in the cause and as such its essence is nothing but the cause. Whether the problem raised by Uddalaka foreshadows this controversy is a question that we cannot evade and the presumption is that Uddalaka's own position anticipates the second of these two views.

The most far-reaching consequence for our understanding of Uddalaka's view of this theory of causality may at once be noted. It is concerning the actual implication of the concept *sat*, or Being used by him to indicate the ultimate reality. As we shall presently see, he argues that from this *sat* successively developed matter in its three primary forms, namely, heat, water and food. Interpreted consistently with his view of causality this cannot but imply that the original *sat*, too, must have been of the nature of primeval matter. Otherwise there is the difficulty of imputing to him the claim that from non-matter originates matter—a form of something coming into being from nothing. Pending further elaboration of this point we have to emphasize that from this consideration alone we are obliged to consider that, as the original source of the world, Uddalaka's *sat* must have been conceived as something like primeval matter. But more of this later.

In the immediate context of our discussion there remains another point to be noted. In a very late hymn of the *Rgveda-samhitā*[35]—which could even be as late as nearing the period of the *Upanisad*-s—we come across a cosmogonical speculation according to which creation emerges from such a stage of utter Nothingness, that it is futile to try even to characterise it either as non-Being or as Being : "Then even nothingness was not, nor existence." Some of the philosophers of the *Upanisad*-s, perhaps under the influence of this cosmogony, argue that in the beginning there is only Non-being.[36] To Uddalaka, however, such a position is clearly untenable. Out of nothing, nothing can originate.[37] Hence he argues that there must have been something in the beginning—some primordial Being—out of which ultimately evolves everything in the universe.

8. THE PRIMORDIAL MATTER : ATOMS & MOLECULES ANTICIPATED

Unlike Thales, Uddalaka refuses to specify his original ground of everything as any gross element of our experience, like water. If any comparison with ancient Greek thought is at all permissible, the original Being of Uddalaka is reminiscent of the "primitive matter" of Anaximander, who is somewhat later than Thales.

Anaximander views his primeval matter (sometimes conceived as the original 'chaos'), as the 'eternal, infinite, indefinite ground, from which, in order of time, all arises, and into which all returns.' But our comparison perhaps has to end here.

There are mainly two reasons for this. First, Uddalaka attempts to work out a systematic account of the evolution of everything in the world—both inorganic and organic—from his original *sat* or Being, though from what comes down to us as

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[35] *RV*. x. 129.

[36] E. g. *Ch. Up*. iii. 19. 1.

[37] This reminds us of *Ex nihilo nihil fit*, a dictum first proposed by Melissus (5th cent. B.C.) and subsequently used by Lucretius (*De rerum natura*) and other materialist philosophers.

Anaximander's thought, he is also groping for some explanation of this only in terms of the original contraries of heat and cold. Secondly, while Anaximander does not allow any quantitative or qualitative designation of this primal matter, in Uddalaka's teaching—as the *Chandogya Upanisad* wants us to believe—there seems to be some hint of first foreshadowing of the molecular and the atomic hypothesis, inasmuch as the finest essence of the Being, which, in Uddalaka's view goes to the making of everything, is made of invisible partless entities. The following forms part of the further dialogue between the father and son in our *Upanisad* :

> 'Bring hither a fig from there.'
> 'Here it is, sir.'
> 'Divide it.'
> 'It is divided, sir.'
> 'What do you see there ?'
> 'These rather fine seeds, sir.'
> 'Of these, please divide one.'
> 'It is divided, sir.'
> 'What do you see there ?'
> 'Nothing at all, sir.'
> Then he said to him, 'Verily, my dear, that finest essence which you do not perceive-verily my dear, from that finest essence this great Nyagrodha (fig) tree arises. Belive me, my dear, that which is the finest essence—this whole world has that as its soul. That is Reality. That is soul. That thou art, Svetaketu.'
>
> 'Do you, sir, cause me to understand even more.'
> 'So be it, my dear,' said he :
> 'Place this salt in water. In the morning come unto me.'
> Then he did so.
> Then he said to him, 'That salt you placed in water last evening —please bring it hither.'
> Then he grasped for it, but did not find it, as it was completely dissolved.
> 'please take a sip of it from this end,' he said, 'How is it ?'
> 'Salt.'
> 'Take a sip from the middle,' said he, 'How is it ?'
> 'Salt.'
> 'Set it aside. Then come to me.'
> Then he said, 'Verily, indeed, my dear, you do not perceive Being here. Verily, indeed, it is here. That which is the finest essence—this whole world has that as its soul. That is Reality. That is soul. That thou art, Svetaketu.'

Understandably, we do not expect a seeker of the ultimate constituent of Reality, who belongs to the eighth or seventh century B.C., to use terminologies sophisticated enough in our standard. Besides, though he uses the word 'soul' or *atman*, it remains for us to see that, for him, it is nothing but this material world. What is stupendous about Uddalaka, nevertheless, is that he wants to conceive the basic stuff of the world as consisting of finest essence, of invisible minute particles, which you come across while dividing a seed of the fig into parts and further sub-dividing each part, or when you dissolve the lump of salt into water, that is, in our terminology, when its molecules get separated into invisible entities. It is because of this that B.M. Barua boldly asserts that "Uddalaka anticipated the atomic theory of Kanada".[38] Judged in its ancient context, again, what appears to us all the more remarkable about Uddalaka is that instead of just proclaiming some theory or seeking any scriptural declaration as its main prop, he wants to demonstrate it on the strength of actual observation at every step, rudimentary though the observation is, as it is only to be expected in his historical context.

It is tempting to go a step further and see in Uddalaka the first experimentalist in history. This is suggested by the remarkable experiment of dissolving a solid lump of salt in water for some stretch of time so that the molecules constituting it get separated and uniformly distributed in what we may call the salt solution. The first experimentalist we meet in ancient Greek tradition was chronologically much later than Uddalaka.[39]

Much more than his conclusions, it is this methodology he follows that makes him so important. For all that we know of his junior contemporary in ancient Greece, Thales, there is nowhere even a hint of any systematic methodology that leads him to the view that water is the ultimate stuff of the whole world.

Assuming—what is sometimes doubted after all—that such a naturalistic understanding of nature makes Thales the first nature scientist in global history, most of the histories of science are left only with the scope of conjecturing *how* he is led to such a view. Uddalaka, by contrast, leaves us with nothing vague about his

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38. Barua 138.

39. Farrington 58 on Empedocles, considered as the first experimentalist.

own procedure, or for any conjecture about the methodology followed by him. With him, therefore, something genuinely new emerges in global history.

9. UNDERSTANDING COSMIC EVOLUTION

We have so far had only a partial idea of the methodology of Uddalaka Aruni. For a more adequate understanding of it, it is necessary to go into some detail of his view.

The starting point of his view, as already seen, is that since only nothing can come out of nothing, the primordial stuff from which evolves everything of the world has to be conceived as Being rather than Non-being. With this view of causality, Uddalaka proceeds to explain how he understands the evolution of the infinite multiplicity of the world from the original Being.

Leaving for the time being the analysis of some terminological peculiarities about which there is much controversy in the later period and to which we shall have to return in our own discussion, we may first briefly sketch the more important points of his view of the evolution of the world.

It seems that this view is best understood in two stages.

From the primeval Being first emerges *tejas*—a word generally translated simply as "heat", though it may as well mean, specially in the context of Uddalaka's discourse, some archaic concept of "energy", of which heat is but a form. But let us not raise any controversy here and accept the usual rendering of the word as "heat".

From "heat" originates "water". Uddalaka wants to give some observational evidence for this, whatever may be its intrinsic worth. As he puts it, "Therefore whenever a person grieves [it is practically a part of ancient and medieval commonsense in the country that grief generates heat within the body, as is evident from such day-to-day use of the word *soka-tapta*, 'heated by grief'] or perspires from the heat, then water [i.e. either tears or perspiration] is produced."

From "water" originates food. This, again, is sought to be supported by some observational evidence: "Therefore, whenever it rains, then there is abundant food. So food for eating is produced just from water."

Uddalaka thus arrives at three fundamental principles being successively produced from the primeval Being, namely heat, water and food. For our understanding, this is the first part of his view of the evolutionary process. The second part of it appears to be much more daring an attempt, the attempt namely of explaining the making of everything in the universe from these three principles : heat, water and food. Before passing on to it, we may as well try to have some clarifications.

Other major views recorded in the *Upanisad*-s, are the products of pure speculation. Unlike others, however, Uddalaka's one seems to be based not on bare speculation. We may perhaps be permitted to characterize it as speculation with a *scientific temper* or of one with a distinct scientific bent of mind, which really makes a world of difference between it and sheer speculation supported at best by scraps of scriptural quotations. This scientific temper which we propose to read in Uddalaka is evidenced by the need he feels for substantiating his propositions with observation of natural facts.

As for the actual worth of the observations on which he relies, one point may as well be noted, which is quite on the surface. Let us not forget the basic fact that we are discussing one who lived over two and a half millennia ago. How much of precision can we at all expect in the observations on which he relies ? Evidently, not much. For substantiating the view that water originates from heat, he mentions the facts that one perspires and sheds tears when tormented by heat. The facts mentioned may be alright. As evidence of water originating from heat, however, this is for us nothing more than pseudo-observation. For substantiating the view that food originates from water, he mentions the fact that whenever it rains there is abundance of food. Though not a pseudo-observation—for the fact remains that the crops depend on rain after all—its worth as proving the thesis that food as an elemental substance originates from water is at best partial.

Therefore, retrospectively analysed, in our standard, the intrinsic worth of the observations is not to be ranked as high. But that is beside our point. The really important point rather is that he is about the first in human history to have *realized the need or importance of substantiating every claim on the strength of actual observation of facts*. This, taken as an index to his attitude—

which we are somewhat obliged to do—shows his scientific temper, because without this whatever he has to say can have no more worth than empty speculation.

While looking back at a thinker belonging to the hoary past, we are supposed to judge him not by the intrinsic worth of his conclusion in our standard but by his attitude and his methodology. What, for example, is the instrinsic worth of the view of Thales, namely that the earth is something like a flat disc floating on water out of which everything in this world is made ? Apparently nothing at all.

Yet, the historians of science have no hesitation in considering him as the first scientist and this primarily because of his attitude—the attitude of developing a naturalistic explanation of natural things, scrapping the earlier mythologico-religious one. Compared to this, however, Uddalaka seems to take a step much nearer to science than is taken by Thales : he not only attempts to develop a naturalistic understanding of natural phenomena but moreover opens the right path of moving towards it, and this by first foreshadowing an essential component of the scientific method, namely the observation of natural phenomena.

It may be added here that judged in the context of his own time and that of the general intellectual climate in which he lives, the step taken by Uddalaka is a revolutionary one. A favourite dictum of the priest-class, repeated over and over again in the *Brahmana*-literature, is : "The gods are fond of the obscure (or the mystic): *paroksa-priyah iva hi devah.*[40]

A junior contemporary of Uddalaka, Yajnavalkya, basically interested in evolving an extravagant world-denying outlook, quotes this dictum, and apparently for the purpose of making its implications clearer, adds to it a brief expression, namely *pratyaksadvisah* i.e. "detestors of direct perception."[41] The full dictum thus amounts to the declaration : "The gods are fond of the obscure (or the mystic) and they detest direct perception." The dictum seriously taken makes nature-science obviously impossible. In such a context of announcing with scriptural sanction the divine distate for direct perception, it must have been severely scientific for Uddalaka to make direct observation of natural phenomena at least one of the main planks of his methodology.

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[40] *Ait. Br.* iii. 33 ; 43 ; *Gopatha Br.* i. 1. 1 ; 7 ; 39 ; ii. 21 ; iii, 19 ; iv. 23 ; *Ait. Aranyaka* ii. 4. 3 ; *Taittiriya Aranyaka* i. 5.9.2 ; ii. 3. 11. 1-4 ; iii. 12. 2. 1 ; 4; 7; *Sat. Br.* xiv, 6, 11, 2; *Aitareya Up*, iii. 14.

[41] *Br. Up.* iv. 2. 2.

10. COSMOLOGY WITHOUT GODS

But let us return to Uddalaka's view of the evolution of the universe.

At the second stage of his discourse, he attempts to show how everything in the universe results from the combination of the three basic elements originating from the primeval matter. Apparently disinterested in mere dogmatic declaration, he seeks for some sort of rational explanation of the mode by which this is possible. Apparently, again, he is confronted here with some inevitable problem. If everything is viewed as made of the combination of heat, water and food, there must be some mark—or perhaps some quality—by which to identify the heat-element, water-element and food-element in the things. Somehow—we do not know exactly how.—he is led to the view that such marks or qualities are respectively "red", "white" and "black" : "Whatever appeared red was the form of heat ; . . . whatever appeared white was the form of water ; whatever appeared black was the form of food". The text does not record for us the considerations that lead him to such an idea and we are left with the conjectures of various possibilities, which would after all be as much untenable as tenable. What is noteworthy, nevertheless, is that such a tendency to associate a particular form of matter with some particular colour somehow or other forms a part of ancient thought. The *Svetasvatara Upanisad* iv.5 mentions precisely the same three colours of the first evolutes of *prakrti* or the unconscious first cause of the universe. In ancient Chinese thought also we come across basically the same tendency, though in a different list of the basic elements. Instead of the five (or four) elements of ancient Indian thought, viz. earth, water, fire, air and sky (*akasa*), the Chinese philosophers had a different list of these, viz. earth, wood, metal, fire and water. What is interesting for us here however, is that there is also the tendency to associate each of these five with a specific colour : earth with yellow, wood with green, metal with white, fire with red and water with black.[42] We do not have at present the scope to digress into the discussion of any comparative merit of the two lists of elements—Indian and Chinese—nor do we intend to investigate why there was this tendency to associate a particular element with a particular colour. Our present point is simply that there was such a peculiar tendency in ancient thought, though the exact reason for it obviously forms the subject of a separate research altogether. What we want to point to is that Uddalaka's approach is not an isolated one judged specially in its ancient context. There must have been some reason leading him to take red as an index to fire, white to water and black to food. In any case, depending on such a trend of thought he proceeds in his own discussion.

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[42] Needham SCC ii. 238.

This much seems to be clear that for him the three primary evolutes of the primeval matter do not exist in their isolation but inevitably in their conjunction or combination. Thus :

> Whatever red form the fire has, is the form of heat ; whatever white is the form of water ; whatever black, the form of food. The fire-hood is gone from fire ; the modification is merely a verbal distinction, a name. The reality is just 'the three forms'.
>
> Whatever red form the sun has, is the form of heat ; whatever white, the form of water ; whatever dark, the form of food. The sun-hood has gone from the sun : the modification is merely a verbal distinction, a name. The reality is just 'the three forms'.
>
> Whatever red form the moon has, is the form of heat ; whatever white, the form of water ; whatever black, the form of food. The moon-hood has gone from the moon ; the modification is merely a verbal distinction, a name. The reality is just 'the three forms'.
>
> Whatever red form the lightning has, is the form of heat ; whatever white, the form of water ; whatever black, the form of food. The lightning-hood has gone from the lightning : the modification is merely a verbal distinction, a name. The reality is just 'the three forms.'

Considering the fact that over twentyfive centuries separate us from Uddalaka, it is difficult to be exact about the details of his cosmogonical view or even about the exact sense he wants to convey by his terminologies. This much is clear, nevertheless, that we seem to have here the first bold attempt to try to explain even the heavenly bodies not only in naturalistic terms but also with the courage to think that all these are made after all of the same stuff as anything else in the universe is, thus making it redundant to remain under any spell of awe or reverence for these.

Here is, in other words, the first attempt to understand nature as it is *without any alien additions*—additions like the fire-god, the sun-god, the moon-god and the lightning-god that crowd the *Rgveda-samhita.* This, by itself is a remarkable intellectual performance of Uddalaka and is an index to his scientific temper, whatever may remain for us obscure in his cosmogony and whatever may be its worth in terms of contemporary knowledge.

11. MAKING OF THE PSYCHO-PHYSICAL ORGANISATION : SCIENTIFIC METHOD

From the account of Uddalaka surviving for us, it appears that cosmogony does not form the focus of his main interest. He seems to give a brief account of it more for the sake of adding some kind of comprehensiveness to his main thesis, namely that the three basic elements originating from the primeval matter go to the making of everything in the universe, inclusive of the heavenly bodies about which his predecessors had all sorts of quaint mythologico-religious ideas.

On the contrary, as is evident from his subsequent discussion, the main focus of his interest seems to be to explain—from the same three primary evolutes, and therefore ultimately from the primeval matter—the making of the human beings, and this inclusive of what he evidently considers the three main peculiarities of man, namely life, mind and speech. In trying to offer a purely naturalistic explanation of all this, Uddalaka—historically speaking—takes a step towards nature-science which is simply stupendous.

First, none before him wants—rationally and naturalistically—to explain the differentia of man, namely life, mind and speech. The very fact that Uddalaka concentrates on the understanding of these three peculiarities of man, may be taken as an index to his scientific temper.

Secondly, as for life, it is the differentia no doubt of the living bodies. However, the very awareness of this differentia is something new in the history of ideas. For all that we know, the early Greek thinkers—inclusive of Thales, particularly with whom we propose to compare Uddalaka in the context of being recognized as the first scientist—are apparently unaware of this. They seem to conceive matter itself as somehow endowed with life, i.e. as something living. That is why in the history of ideas the need is usually felt for a new terminology appropriate for their real position. The term thus introduced is *hylozoism*, though the real advance of it from primitive animism appears to be somewhat marginal.

Thirdly, be that as it may, the fact is that none before Uddalaka makes any conscious attempt to pose the question of the origin of life. Uddalaka does it and it may even be an error to denude his conclusion of any scientific interest, inasmuch as—when it comes to brasstacks—he somehow tries to understand the origin of life from water.

Fourthly, none before him raises the question of the making of mind, which Uddalaka does, and he wants us to view it as originating from the minutest constitutents of the food consumed.

Fifthly—and there is no question of not viewing it as most remarkable in the history of science—Uddalaka does not simply assert it on the basis of mere speculations but moves forward to offer an *experimental demonstration* in favour of this view. *All other considerations apart, it is this methodology of experimental demonstration that entitles him to be recognised as the first scientist in global history*. It is particularly on this point that he appears to be free from the need of any concession as belonging to the ancient period. The essentials of his mode of experimentation obviously contains a good deal of importance—or at least the potentials thereof—of the experimental method for centuries to come. There is no doubt, as J.D. Bernal wants us to remember, "The method of science is not a fixed thing, it is a growing process."[43] Nevertheless, from the historical viewpoint, what matters most is the prodigious first step taken to it. Uddalaka not only takes this step already in the eighth or seventh century B.C. but moreover the essentials of this retains significance even upto the time of John Stuart Mill.

Lastly, Uddalaka somehow wants to explain also the making of "speech" (*vac*) from the minutest constituents of *tejas* element, which, we have agreed to translate as "heat". What exactly he is referring to by the word is however a point that seems to require further investigation and as such his view of the origin of speech is not fully clear to us. But this may not be because of anything in Uddalaka's statement but because of the present in-

[43] Bernal 35.

adequacy in our understanding of one of his key terminologies. At the same time the fact remains that he is undoubtedly the first in the history of global science to have felt the need of offering a rational and essentially naturalistic explanation of the making of "speech", and this evidently because he feels that, like "mind", speech is a characteristic peculiarity of the human beings.

In substantiation of the points mentioned above, it is necessary for us to quote in full the passage in which Uddalaka explains the making of man—a passage that seems to have the unique importance of being the earliest specimen of scientific literature :

> [Uddalaka explains to his son :] 'Food when eaten, becomes divided into three parts. That which is its coarsest constituent becomes the feces ; that which is the medium, the flesh ; that which is minutest, the mind (*manah*).
>
> 'Water when drunk, becomes divided into three parts. That which is its coarsest constituent, becomes the urine ; that which is the medium, the blood ; that which is the minutest, the life (*prana*).
>
> 'Heat [which the later commentators explain as oil, *ghee* or melted butter, etc. perhaps under the influence of the ancient medical view ; of. *Caraka-samhita,* e.g. i.13.14] when eaten, becomes divided into three parts. That which is its coarsest constituent, becomes the bone ; that which is the medium, the marrow ; that which the minutest, the speech (*vac*).
>
> 'For, my dear, the mind consists of food ; the life consists of water, the speech consists of heat.'
>
> [The son said :] 'Do you, Sir, cause me to understand more.'
>
> 'Of coagulated milk, my dear, when churned, that which is the minutest constituent all moves upward ; it becomes butter.
>
> 'Even so, my dear, of food when eaten, that which is the minutest constituent all moves upward ; it becomes the mind.
>
> 'Of water, my dear, that which is the minutest constituent all moves upward ; it becomes the life.
>
> 'Of heat (? oil, *ghee* etc.), my dear, when eaten, that which is the minutest constituent all moves upward ; it becomes speech.
>
> 'For, my dear, the mind consists of food ; the life consists of water, the speech consists of heat.'
>
> [The son said :] 'Do you, sir, cause me to understand more.'
>
> 'So be it, my dear,' said he [and continued :]
>
> 'A person, my dear, consists of sixteen parts.
>
> For fifteen days do not eat ; drink water at will. Life, which consists of water, will not be cut off from one who drinks water.'
>
> Then for fifteen days he did not eat.

> So then he [the son] approached him [Uddalaka], saying, 'What shall I say, sir ?'
>
> 'The *Rg* [verses of the *Rgveda-samhita*], my dear, the *Yajus* [the spells in the *Yajurveda-samhita*], the *saman* [the melodies of the *Samaveda-samhita*].'
>
> Then he [the son] said, 'Verily, they do not come to me, sir.'
>
> To him, he [Uddalaka] said, 'Just as, my dear, a single coal of the size of fire-fly may be left over from a great kindled fire, but with it the fire would not thereafter burn much—so, my dear, of your sixteen parts a single sixteenth part may be left over, but with it you do not apprehend the Vedas. Eat, then you will understand from me.'
>
> Then he ate. So then he approached him. Then whatsoever he [Uddalaka] asked him, he answered everything. To him, he [Uddalaka] then said :
>
> 'Just as, my dear, one may, by covering it with straw, make a single coal of the size of a fire-fly that has been left over from a great kindled fire blaze up, and with it the fire thereafter burns much—so, my dear, of your sixteen parts a single sixteenth part has been left over. After having been covered with food, it has blazed up. With it you now apprehend the Vedas ; for, my dear, the mind consists of food, the life consists of water, the speech consists of heat.'
>
> Then he understood from him—yea, he understood.

Before proceeding further, let us ask ourselves a simple question. What is in essence the method that Uddalaka is following ? There can be only one answer to it. It is nothing but the method of observation and experiment.

It may not be irrelevant to note here an exceedingly interesting evidence from the later Indian philosophical literature which cannot but be reminiscent of Uddalaka's experiment wanting to show that mind is the product of food after all. This evidence is to be found in the work called *Nyayamanjari* of Jayanta-bhatta who belonged to *c.* eighth century A.D. and is considered to be a very renowned representative of the Nyaya-Vaisesika view. In his zeal to refute the well-known view of the plain-speaking materialists or Carvakas, according to which consciousness is only a product of matter (*bhuta-caitanyavada*), he comes out with an observation the significance of which is rarely noted in the works of Indian philosophy.

Following the Indian practice of first representing the opponent's position (*purvapaksa*) Jayanta mentions a number of arguments on the basis of which the materialist would like to establish his own theses. One of these is as follows (*Nyaya-manjari*, II, p. 13): "There exists 'agreement in presence' as well as 'agreement in absence' between the material body and consciousness. It is often observed that a body well-nourished with food and drinks has improved consciousness, while the reverse is observed in the reverse case. Further, the body of the young man who takes Brahmighrta shows remarkable improvement of consciousness... Thus the improvement or deterioration of consciousness is directly explicable by the presence and absence of the material elements consumed."

The argument is cryptically put and we can first see its full implication. The comparatively later Indian philosophers are on the whole agreed that for establishing the causal connection between two phenomena it is necessary to point to the agreement in presence (*anvaya*) as well as the agreement in absence (*vyatireka*) between the two. According to Jayanta, the materialists follow the procedure in defending their theory that consciousness is a product of matter. Thus it is observed that when a person's body is well-nourished with food etc. he acquires improved consciousness (*pattvi cetana*). By contrast, the consciousness of the undernourished person shows remarkable deterioration.

From the point of view of our present discussion the most important question is: wherefrom does Jayanta collect this argument, which he considers typical of the materialists? The claim that he perhaps does it from some materialist text now lost to us would be a conjecture without any basis whatsoever. However, it would be a worse conjecture that he conjures it out of his own brain, particularly because basically the same drift of argument is to be found in the *Chandogya Upanisad*, a text with which Jayanta's want of acquaintance is not easily imaginable. In short, in the entire range of Indian philosophical literature there is only one place which provides this argument—or may be its prototype—and that is Uddalaka's experimental verification of the point we have just quoted. Evidently therefore Jayanta understood Uddalaka's experiment as substantiating a well-known theory of a plain-speaking materialist, namely *bhuta-caitanya-vada*. But let us return to the question of Uddalaka's position in the history of global science.

It is sometimes suggested[44] that some kind of observation forms the background of the view of Thales too. It is the observation of land emerging from inundated areas. Even admitting this, we have to admit further that it is really a case of pseudo-observation or mal-observation—the land re-emerging being viewed as coming into being. Besides, the actual core of experience on which he builds his thesis is presumably borrowed from the ancient Egyptians and Babylonians. It is hinted, again,[45] that his view of the earth as a flat disc floating on water may be suggested by the observation of his homeland being but a tiny island surrounded by water. As for the value of this observation for justifying his thesis, perhaps the less said the better. Leaving him, when we look back at Uddalaka, we cannot help feeling that we are entering a different realm of viewing things altogether. Though rudimentary in contemporary standard, his observations are generally genuine and also relevant in defence of a thesis far more meaningful than that of Thales.

But not simple observation alone. Specially in defence of the view that mind is made of the minutest particles of food digested, Uddalaka goes in for a method which is nothing short of being experimental : Other circumstances allowed to remain the same, in the presence of eating food there is the presence of mind, while in the absence of eating food there is the absence of mind.

Equipped with this methodology—and presumably drawn by the attraction of comprehensiveness—Uddalaka tries to explain other aspects of man like sleep, hunger, thirst and death—the last as the gradual reversal of the evolutionary process, namely food returning to water, water to heat and heat to the primeval matter again. It is not necessary for our present purpose to go into the details of this aspect of his view, much of which are formula-like repetitions of practically the same thing and, in any case, without having anything more spectacular to add to what is already noted about him. But the way in which he sums up his main thesis more than once in his discourse may as well be quoted for a fuller understanding of his position. As the *Chandogya Upanisad* records it :

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[44] Burnet 21.

[45] *Ibid.* 20.

'On this point, my dear, understand that this (body) is a sprout which has sprung up. It will not be without a root.

'What else can its root be than food? Even so, my dear, with food for a sprout, look for water as the root. With water, my dear, as a sprout, look for heat as the root. With heat, my dear, as a sprout, look for Being as the root. All creatures here, my dear, have Being as their root, have Being as their home, have Being as their support......

'As the bees, my dear, prepare honey by collecting the essences of different trees and reducing the essence to a unity, as they are not able to discriminate "I am the essence of this tree", "I am the essence of that tree",—even so, indeed, my dear, all creatures here, though they reach Being, know not : we have reached Being.

'Whatever they are in this world, whether tiger, or lion, or wolf, or boar, or worm, or fly, or gnat, or mosquito, that they become.

'That which is the finest essence—this whole world has that as its soul. That is reality. That is *atman* (soul). That art thou, Svetaketu.'

[The son said :] 'Do you, Sir, cause me to understand even more'. 'So be it, my dear', said he [and continued].

'These rivers, my dear, flow, the eastern toward the east, the western toward the west. They go just from the ocean to the ocean. They become the ocean itself. As they know not 'I am this one', 'I am that one' —even so, indeed my dear, all creatures here, though they have come from Being, know not 'we have come forth from Being'. Whatever they are in this world, whether tiger, or lion, or wolf, or boar, or worm, or fly, or gnat, or mosquito, that they become.

'That which is the finest essence—this whole world has that as its soul. That is reality. That is *atman* (soul). That thou art, Svetaketu.'[46]

12. *DEVATA* (DEITY) AND *ATMAN* (SELF)

In view of what is so far discussed, it is not an exaggeration when B.M. Barua asserts :[47] "In accordance with his physical doctrine, Uddalaka propounded an empirical theory of knowledge. Henceforth let no one speak, he asserts, of anything but that which is heard, perceived or cognised. He seems repeatedly to point out : the only right method of scientific investigation into the nature of reality is that of inference by way of induction."

His basic theme is that of the making (or evolving) of everything in the universe ultimately from the primeval matter. From this naturally follows the view that in the ultimate analysis man is nothing but an evolute of it—a view formulated in our text by the oft-repeated formula "That thou art, Svetaketu". There is no scope anywhere in this formula itself for any divine agency or any spiritual agency having anything to do with the making of man. This makes his entire discussion starkly naturalistic or the zeal to understand "nature as it is *without any alien addition*," which, according to one trend of philosophy at any rate, is the essence of the materialistic outlook forming the real foundation of natural science.

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[46] *Ch. Up.* vi. 8. 5. ff.

[47] Barua 138.

But there may be some doubt about all this because Uddalaka is recorded to have used terms like *devata* (deity) and *atman* (self) in his discourse. What is questionable, however, is how far he could have used such words in their usually accepted senses, wanting us to amend our understanding of him as preparing the soil for natural science and this on the basis of an essentially naturalistic or materialistic outlook. We are therefore required to be clear about the possible senses in which Uddalaka wanted us to understand these terms.

How are we to understand the word *devata* which in the *Chandogya Upanisad* is used by Uddalaka to refer to not only the primeval being or *sat* but also to the three primary evolutes of it, namely, heat, water and food (*Ch. Up*. vi. 33. 2-4). Are we to think that Uddalaka has taken some kind of a pantheistic outlook seeing God everywhere or that he is really inclined to develop the rudiment of a theistic world-outlook?

B.M. Barua has already faced this question and has rightly warned us against such possibilities. The word *devata* in his discourse, in other words, is to be understood without any theological overtone. As he puts it, "Uddalaka's Deity (Devata)...... is a most baffling term. But nothing is more certain than that it is on the whole a physical conception. We may suppose that in the realm of change the term applies to Matter or the Material, . . . or at best we might interpret the term Deity as meaning that highly concentrated or attenuated form of matter which admits of no distinction whatever from mind, spirit or energy—a condition in which matter is transformed into energy, acts as the vivifying principle, and therefore not distinguishable from motion itself . . . Uddalaka had no other expression for Matter than Deity (Devata)."[48]

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[48] *Ibid*. 132-33.

It may not be irrelevant to add here that such a secular or non-religious use of the word for deity or 'god' is quite conceivable in the ancient world, as it is attested also by the Greek evidences. As Burnet observes, "The spirit of Ionian civilisation had been thoroughly secular, and this was, no doubt, one of the causes that favoured the rise of science... For our present purpose it is of most importance to observe that it was just this non-religious use of the word 'God' which made it possible for the Milesians to apply it to the primary substance and their 'innumerable worlds'. That way of speaking does not bear witness to any theological origin of Greek science, but rather to its complete independence of religious tradition."[49]

So it seems had presumably been the case also of Uddalaka. His way of speaking of the primeval being—as also of heat, water and food—as *devata* can hardly be justified to construe a spiritualist of him.

As for the word *atman* used by him, Uddalaka himself leaves us with no doubts or uncertainty. By it he meant something completely going against the idealistic view of pure spirit or soul, which dominated the intellectual climate of the Upanisadic India. Thus we are told in another Upanisadic text[50] that when in the company of a few other scholars he went to a certain king called Asvapati Kaikeya,

> The king said to Uddalaka Aruni : "Gautama ! Whom do you reverence as the *atman* ?
>
> 'The earth indeed, Sir, O king', said he.

From the viewpoint of the king himself this was of course a totally unsatisfactory answer. Nevertheless it shows that Uddalaka is much too earth-minded or this-worldly a thinker to have any patience for an idealistic outlook. It is from this point of view that we are to understand his famous formula "That thou art" (*tat tvam asi*), which he repeatedly tells his son. Though the later idealists wanted to take the formula as one of the 'great sayings' (*mahavakya*) on which their own view of identifying the ultimate reality (*brahman*) with soul in its absolute purity (*atman*) was based, Uddalaka himself had surely a very different understanding of *atman* itself. Since, however, he wanted to impress upon his son that in the ultimate analysis Svetaketu himself—like everything else in the world—was nothing but primeval matter or *sat,* how else could he express the point but repeat a number of times the importance of realizing that Svetaketu himself was nothing but this *sat*, primeval matter? "That thou art" simply meant "you are only the same primeval being," as is everything in nature.

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[49] Burnet 28-29.

[50] *Ch. Up*. v.17.1.

It is therefore no wonder that in the Upanisads we find Uddalaka's total unawareness of the concept of the transmigration of the soul. Thus we read[51] that when in the assembly of the king of Kuru-Pancala the royal flatterers (*rajanyabandhu*) ask Svetaketu questions concerning the paths by which the departed soul moves—the path of the fore-fathers (*pitryana*) and that of the gods (*devayana*)—Svetaketu felt flabbergasted and returned to his father, accusing him of not teaching such matters. Uddalaka frankly confessed that he had himself no idea about all this. So he went to the royal court to learn what others had to say about the subject. Though the text tells us that he had the patience to listen to the doctrines about the paths by which the departed soul was supposed to move, we have nowhere in the Upanisads even any remote suggestion of this view making any dent on his own. On the contrary, the phenomenon called death was understood by him as the return of the body to food, water and heat, and therefore ultimately to the *sat* or primeval matter.

Thus the use of words like *devata* and *atman* by Uddalaka notwithstanding, his teaching can hardly be made to deviate from his basic naturalism.

13. IMPACT OF UDDALAKA ON INDIAN THOUGHT

There remain some more problems to be discussed about this philosopher-scientist. What was the impact of Uddalaka's views on the subsequent course of Indian thought? This is perhaps best done in two parts.

First, what has been this impact *on the surface*?

Secondly, what has been this impact *under the surface*?

First—i.e. on the surface—Uddalaka's science has little or no impact on the immediate intellectual climate of his time. On the contrary, it is subjected to a process of an almost endless distortions. Before passing on to the nature of these distortions, it may as well be relevant to try to understand the causes that necessitate these.

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[51] *Br. Up*. vi. 2. 1 ff. Cf. *Ch. Up*, v. 3.

Winternitz says, "It proved fatal for the development of Indian philosophy that the *Upanisad*-s should have been pronounced to be 'revelations', and sacred texts ; for in the *Upanisad*-s we still find vigorous, independent, creative philosophical thought, which grew rarer and rarer in the later development of Indian philosophy for the very reason that progress was not only hindered at every step by the fetters of the dogmatism of the schools but still more by the orthodox belief that every word of an *Upanisad* must be regarded as divine truth."[52]

What concerns us in our present discussion is how far this orthodox view creates difficulties for us to understand the actual monolithic philosophy.

Evidently, since it would be a grave derogation for revelation of divine truth to contain adventure of ideas in diverse directions not in full conformity with each other, orthodoxy demands that all the *Upanisad*-s in all their passages must contain a single or monolithic philosophy.

What, then, is supposed to be the main theme of this philosophy? Deussen, in full accord with Brahmanical orthodoxy, claims that "all the *Upanisad*-s treat of the same subject, the doctrine of *brahma* and *atman*",[53] or, more specifically the identity of the two. Only with the notable exception of Uddalaka's discourse, which as we shall presently see, creates a great deal of headache for orthodoxy, *brahman* is the typical Upanisadic term for the ultimate reality, while *atman* means the self—freely understood as the pure spirit or pure soul or simply a mass of consciousness.[54] It easily follows from the identity of the ultimate reality with the pure soul that the empirical world with the infinite multiplicity of things must be somehow unreal—something like the foolish phantom produced by sheer ignorance, the Sanskrit word for which is *avidya*. This makes all effort to understand nature—and therefore nature-science itself—a futile if not stupid enterprise.

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[52] Winternitz i. 265.

[53] Deussen PU 39.

[54] *Vijnanaghana*.

[54] *Vijnanaghana. Br. Up.* ii.4.12.

Peculiarly enough, it is precisely this hostility to science that makes Deussen highly enthusiastic about what he considers to be the main drift of the philosophy of the *Upanisad*-s. As he puts it :

"Very soon, however, it came to be realised that this knowledge of Brahman was essentially of a different nature from that which we call 'knowledge' in ordinary life. For it would be possible, like Narada in the *Chandogya* to be familiar with all conceivable branches of knowledge and empirical science, and yet to find oneself in a condition of ignorance (*avidya*) as regards the Brahman. This thought, originally purely negative, became in course of time more and more positive in its character. It was negative in so far as no experimental knowledge led to a knowledge of Brahman; and it was positive in so far as the consciousness was aroused that the knowledge of empirical reality was an actual hindrance to the knowledge of Brahman. The conception of *avidya* was developed from the negative idea of mere ignorance to the positive idea of false knowledge. The experimental knowledge which reveals to us a world of plurality, where in reality only Brahman exists, and a body where in reality there is only the soul, must be a mistaken knowledge, a delusion, a *maya*. This is a very notewrothy step in advance. It is the same which Parmenides and Plato took when they affirmed that the knowledge of the world of sense was mere deception, which Kant took when he showed that the entire reality of experience is only apparition and not reality. It is of the greatest interest to follow up the earliest foreshadowings of this thought in India, and to trace how the term *avidya* passed from the negative idea of ignorance to the positive idea of a false knowledge."[55]

With obvious reservation for what is said here about Kant,[56] the comparison with Plato and Parmenides has its own interest, because both developed a metaphysics that proved inimical for natural science. For the present, however, our point is a different one. It needs at once to be noted here that Uddalaka is about the only major philosopher in the entire corpus of the Upanisadic literature never to have used the word *brahman* in expounding

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55. Deussen 74-75.
56. It is palpably absurd to put Kant in the company of Plato and Parmanides but we have no scope here to digress on this point.

his own view. But admitting Uddalaka Aruni to be a prominent thinker in the *Upanisad*—which Deussen does and in fact is obliged to do—and admitting further that his understanding of the philosophy of the *Upanisad*-s is acceptable, there can hardly be any scope to look back at Uddalaka as the originator of nature-science, which we have been trying to establish. Incidentally, Deussen is not the only scholar to take such a view. Tons of books written in European and Indian languages take at least a closely similar view, though may be not always with the same enthusiasm for the denunciation of natural science. Uddalaka's total apathy to the very concept of *brahman* is conveniently overlooked and he is sought to represent the *bramhan-atman* philosophy. But the later Indian tendency to look at the entire Upanisadic literature as scriptural and hence as containing a monolithic doctrine proved to be a many-sided disaster for the objective understanding of our ancient tradition. One aspect of this is the failure to recognize the extremely interesting position of Uddalaka Aruni, the first scientist known to us.

It is one of the reasons why even in the histories of science written with pronounced aversion for the prejudice of Eurocentrism that Uddalaka's name remains totally unknown. It gets lost under the generalized claim that the *Upanisad*-s preach only a world-denying philosophy, the obvious implication of which is that there can be no scope for nature-science in these.

But why do the average writers on the *Upanisad*-s both in India and abroad take such a view of their essential philosophical content, ignoring the obvious fact that "their inner structure reveals that they are heterogeneous in their material and compound in their composition"[57] and that in these texts "the various strands of thought are almost inextricably interwoven, and the teaching presented is with difficulty reduced to self-consistency" ?[58] The answer is that the modern writers on the *Upanisad*-s cannot easily outgrow the spell of the orthodox claim that, howsoever difficult it may be to read only one self-consistent philosophy in these, the *Upanisad*-s as revelations cannot contain any inner inconsistency. Inconsistency if any, cannot be anything more than apparent. It is for the purpose of proving this that there came into being a text called *Vedanta-sutra* or *Brahma-sutra*—the *Upanisad*-s being, in the orthodox view, but Veda-end or Vedanta, and the term usually used in these for the ultimate reality being Brahman. The work is attributed to a certain Badarayana. Nothing historical is known of him and the date of the actual redaction of the philosophical view in the work in the form of cryptic sentences or half-sentences—called *sutra*-s—in uncertain. Dasgupta conjectures that it could have been the second century B.C., though in Jacobi's view it was sometime between A.D. 200 and 500. Whatever that may be, the fact is that since the composition of this work, it was accepted as the source-book for the understanding and expounding of *the Upanisadic philosophy*—the expositions generally assuming the form of commentaries on it. Not that the major commentators of the work are in agreement with each other in understanding all the aphorisms in the same way. They often sharply differ with each other and propose to evolve different understandings of the Upanisadic philosophy. Such understandings are generally mentioned as different schools of the Vedanta philosophy, each school extensively quoting from the *Upanisad*-s to justify its own position. From the point of view of what we are discussing, however, these are differences after all within the structure of a general agreement, inasmuch as no commentator of the *Brahma-sutra*—and hence none of the school of Vedanta—agrees to see anywhere in the *Upanisad*-s even any remote hint of the making of nature-science.

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[57] Bhandarkar 1.

[58] *Ibid*.

As is only to be expected, these commentators of the *Brahma-sutra* are confronted with some major difficulty when they come to the view of Uddalaka Aruni. One reason for this is quite on the surface. Contrasted with the general run of the other Upanisadic philosophers, *Uddalaka never uses the word "brahman" to refer to the ultimate reality*. Instead of this, he simply uses the word *sat*—for reasons already discussed—which can only mean the primeval matter. The crucial question of Uddalaka's deviation from the standard terminology of his age—his total refusal to use the word *brahman* anywhere in his own discourse is conveniently overlooked by the later commentators. What they concentrate upon is another point altogether. Unless, Uddalaka's *sat* is somehow made to mean nothing but what others call the *brahman*, his views cannot be brought in conformity with the

Vedanta philosophy as understood by any of its school. The most tortuous attempt is therefore made by the commentators of the *Brahma-sutra* to make *brahman* out of Uddalaka's *sat*.

We shall mention two of the most outstanding commentators of the *Brahma-sutra* to illustrate this. One of them is Samkara (*c*. A.D. 788-829) and the other Ramanuja (*c*. 11th century A.D.). The two sharply differ no doubt from each other in explaining the fundamental teachings of the *Upanisad*-s. In fact Ramanuja's polemic against Samkara is one of the longest and a tough-reading one that we have in our philosophical literature. When, however, it comes to the question of interpreting the view of Uddalaka, specially his conception of the *sat*, Samkara and Ramanuja are surprisingly in total agreement with each other and make the most strenuous efforts to show that it cannot mean anything but the ultimate spiritual principle, the standard Upanisadic term for which is *brahman*. We are going to see how flimsy are the arguments which both of them try desperately to cling to for the purpose, and what is worse, how both feel obliged to overlook or ignore many an evidence to make a typical spiritualist of Uddalaka.

To begin with, it needs to be noted that the zeal shown by both Samkara and Ramanuja is much more than a matter of terminological preference.

One of the famous philosophies in the country—called the Samkhya—comes down from a hoary antiquity : about its exact origin, the modern scholars are yet far from being clear or unanimous. Though much of its original form is admittedly lost, accordingly to the form in which it reaches us the whole universe evolves from primordial matter called *pradhana* or *prakrti*. As Uddalaka's *sat*—like his view of causality—is strongly reminiscent of it, later philosophers with their spiritualistic understanding of the Upanisadic thought are above all anxious to show that it can by no means imply anything like the *prakrti* or *pradhana* of Samkhya philosophy.

Their great anxiety to prove that this *sat* is not anything material shows that they sense the strong possibility of a materialist understanding of it. It is perhaps not difficult to see why they do so. Uddalaka's opening argument, viz. that from 'Non-being' can never be produced 'Being', logically implied that the effect potentially pre-exists in the cause, and hence the nature of the cause is to be inferred from the nature of the effect—a theoretical position worked out in the Samkhya philosophy as *sat-karya-vada* or the theory of the potential pre-existence of the effect in the cause. Starting from basically the same theoretical position or its prototype, when Uddalaka agrues that from the original *sat* successively evolve three material elements, viz. heat, water and food, the obvious presumption is that this *sat* itself contains the potentials of matter, and in this sense is itself something material. Otherwise, from his standpoint, there is the absurdity of 'matter' being produced from 'non-matter' or 'the absence of matter'—a form of 'Being produced from 'Non-being'. This, in short, is presumably the reason why the Vedantic idealists apprehend the possibility of understanding Uddalaka's *sat* as something like the *pradhana* of Samkhya philosophy, an understanding which at any cost has to be rejected by them because of their own view of the scriptural nature of the *Upanisad*-s.

Already in the *Brahma-sutra* a number of reasons are given to prove a spiritual interpretation of Uddalaka's *sat*. In their commentaries, famous Vedantists like Samkara and Ramanuja elaborately explain these.

The more prominent of their arguments may be briefly examined here. The first of these is philological, based on the right interpretation of the words used by Uddalaka. His exact words describing the evolution of fire from *sat* are : "It (*sat*) bethought itself : 'Would that I were many ! Let me procreate myself." It emitted heat." The very expressions used by Uddalaka show that by original being he cannot mean an unconscious first principle like the *pradhana* of Samkhya. As Ramanuja explains : "That which does not rest on scripture, i.e. the *pradhana*, which rests on inference only, is not what is intimated by the text referring to the origination of the world ; for the text exhibits the root —*iks*—which means, 'to think'—as denoting a special activity on the part of what is termed 'being' : 'It thought, may I be many, may I grow forth.' 'Thinking' cannot belong to the non-sentient *pradhana* : the term 'being' (*sat*) can therefore denote only the all-knowing highest Person who is capable of thought".[59]

Samkara also argues on the same lines, though much more elaborately. However this evidence of the exact words used by Uddalaka does not really prove much, because in the very next

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59. Ramanuja on *Br. Su.* i. 1. 7.

sentences describing the evolution of water from heat and of food from water, he uses identical words.

"That heat bethought itself : 'Would that I were many. Let me procreate myself.' It emitted heat. That heat bethought itself : 'Would that I were many ! Let me procreate myself.' It emitted water. . . The water bethought itself : 'Would that I were many ! Let me procreate myself.' It emitted food".[60]

Thus, if the use of the root *iks*—"to think"—with reference to *sat* or original being really means that it is something spiritual, the same evidence results in the view that even the crassly material elements like heat, water and food are conceived by Uddalaka as spiritual. This is plainly absurd. What, then, can be the possible significance of the use of such words ? Can it be that they are only figurative expressions used by the ancient philosopher to exclude the possibility of any outside agency—any external will—for the explanation of the evolution of heat from the original being, as of water from heat and food from water ? Or, is it because, as Ruben[61] suggests, Uddalaka—like Thales—is actually a hylozoist, i.e. a primitive materialist viewing matter itself as something living ? In view of the specific explanation attempted by Uddalaka of the evolution of life (*prana*) from water, perhaps the presumption is in favour of the first alternative. In any case the evidence of the use of his expressions cannot prove that the original being or *sat* is conceived by him as a spiritual principle, unless the later Vedantists agree to admit that the Upanisadic sage takes the same view of heat, water and food.

Secondly, Ramanuja argues, by *sat* Uddalaka cannot mean anything like *pradhana* or the primeval matter of Samkhya philosophy, because the doctrine of *pradhana* is based simply on inference and not on the scriptures. Such an argument, however, is based only on a gross distortion of the teaching of Uddalaka as recorded in the *Upanisad*.

We have already seen the context of his discourse. When Svetaketu returns home after studying the scriptures for twelve years and is full of arrogance of his scriptural knowledge, Uddalaka asks him the question concerning the first cause, which he cannot do if he considers scriptural knowledge enough for philosophical purposes. Besides, the very pattern of his quest for the first cause shows that he is primarily interested in inferring it on the basis of direct observation, in the way in which clay is inferred as underlying all earthen things or iron underlying all iron instruments.

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[60] *Ch. Up.* vi. 2. 3.

[61] Ruben SAIT 80.

But, argue both Samkara[62] and Ramanuja,[63] there is a decisive proof for the *sat* of Uddalaka being something else than a mere material principle. At the end of each stage of the discourse, referring to the *sat*, Uddalaka says : "That which is the finest essence—this whole world has that as its soul. That is Reality. That is *atman*. That art thou, Svetaketu." If *sat* means something material, how can it be thus equated to the soul? The very equating of this *sat* with the soul proves that Uddalaka is talking of some spiritual principle. Besides, argue both Samkara and Ramanuja, if *sat* means something material, the talk of it to Svetaketu can only mean utter confusion for him, because Svetaketu is after all desirous of final release or *moksa*, which can result only from the knowledge of an intelligent soul and never from the knowledge of any material first cause.

We have already seen what Uddalaka means by *atman*. For the present the question remains about final release or liberation. How can Uddalaka, asks Ramanuja, speak of a material first cause to "Svetaketu, who is desirous of the final release ?" "If", he continues, "On the other hand, the text would teach that the non-intelligent *pradhana* [or primeval matter] is the general cause, it could not possibly teach that meditation on this *pradhana* being a man's self is the means towards his Release."

Argues Samkara :

"If the non-intelligent *pradhana* were denoted by the term *sat* and did comprehend—by means of the phrase 'that art thou'—persons desirous of final release who as such are intelligent, the meaning could only be 'Thou art non-intelligent' ; so that scripture would virtually make contradictory statements to the disadvantage of man, and would thus cease to be a means of right knowledge. But to assume that the faultless *sastra* [scripture] is not a means of right knowledge would be contrary to reason. And if the *sastra*, considered as a means of right knowledge, should point out to a man desirous of release, but ignorant of the way to it, a non-intelligent self as the real self, he would—comparable to the blind man who had caught hold of the ox's tail—cling to the view of that being the self, and thus never be able to reach the real self different from the false self pointed out to him ; hence he would be debarred from what constitutes man's good, and would incur evil".

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[62] Samkara on *Br. Su.* i. 1. 7 f.

[63] Ramanuja on *Br. Su.* i.1.7 f.

From Uddalaka's own standpoint, however, all these discussions are really strange. They presuppose an assumption of which Uddalaka shows neither any interest nor even the least awareness. The basic assumption of the commentators like Samkara and Ramanuja that Svetaketu approaches Uddalaka for that philosophical illumination which ensures final release from the fetters or the bondage to the material world is completely gratuitous. The long discourse of Uddalaka recorded in the *Chandogya Upanisad* simply shows that the scientist-philosopher is keen on having a better insight into the material world itself, which is not obtained even by a full course study of the scriptural lore for twelve prolonged years. All this is completely new in the Upanisadic literature which makes the basic quest of Uddalaka something unique. His essentially scientific curiosity and the zeal to rouse the same in his son reminds us of Thales who also wants to enquire into the first cause of the world in an essentially secular sense, though for all that we know of Thales he hardly gives us the impression of any systematic methodology as is definitely followed by Uddalaka.

Incidentally, as a total anti-climax to the claim of Samkara and Ramanuja that Svetaketu approaches his father for the knowledge of that which leads to liberation or *moksa,* it may be noted here that, far from having anything to do with *moksa,* Svetaketu is actually remembered in the country as the founder of the science of sexology or *kama-sastra.* About this the source-book of this science, called the *Kama-sutra* is quite categorical.[64] A somewhat obscure passage in the *Brhadarayaka Upanisad* (vi.4) seems to suggest that Uddalaka himself is also interested in it. Evidently sex and salvation are not the same.

The crucial point for understanding Uddalaka is thus to note that he represents a trend of thinking altogether different from the spiritualistic-idealistic view of the *Upanisad*-s.

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[64] *Kamasutra—Sadharanamadhikaranam* 9.

Apart from B. M. Barua, whom we have already quoted, among the modern scholars, we are indebted specially to Jacobi and Ruben for the right revaluation of Uddalaka's contributions. Here is how Ruben puts it :

"My revered teacher Herman Jacobi was the first to maintain that Uddalaka taught some materialistic elements. He started from the struggle between the later Samkhyas who claimed that the *sat* of Uddalaka was matter (*prakrti*) while later Vedantins interpreted it as *brahman*." Ruben himself has followed up this suggestion : "In 1961, I wrote finally a paper about the beginning of rational thinking in India, describing how the fight between materialism and idealism—between Uddalaka and Yajnavalkya —began in ancient India, when a few and small Indian states in the Ganges-valley had been just founded in the iron age in contrast to the mass of tribes, when class-struggle was beginning, when accordingly ideological competition started.....Sciences like medicine started fighting against religion, physicists against Brahmins ; astronomy, geography, law, state-doctrine etc. began : discussions became characteristic of this new period of ancient Indian history, doubt was in fashion in all fields of consciousness, and only then the fight between materialism and idealism began on the basis of all this social and ideological struggle, especially after scientific thinking had begun, although the sciences were not yet fully developed. Uddalaka showed in his philosophy this new scientific type of thinking in his ways of arguing and proving his doctrines with reasonings and analogies, as a forerunner of later logicians who developed the analysis of *anumana*, *drstanta*, etc."[65]

In this connection, Ruben's paper on "Uddalaka and Yajnavalkya" needs to be read in full. But we quote here only another passage from it because of its bearing on the subject we are discussing :

"This materialism is further expressed in Uddalaka's doctrine that mind is becoming out of food, just as *prana* (life) out of water and speech out of fire. It was common among the ancient thinkers to identify speech with fire and life with water. But to claim that mind is food is stupendous. It was the climax of this text of Uddalaka teaching his son Svetaketu and he felt the necessity to prove this thesis. Therefore, he used the churning of milk as analogy to human digestion...... And finally he made his son undergo the experiment of fasting in order to show that drinking water keeps him alive but avoiding food makes him lose his thinking (mind). When he eats again, his knowledge, his mind, comes back, as we would say, or his mind is recreated by food, as Uddalaka taught. This conception reminds us of later Samkhya ideas according to which *buddhi* is the first product of *prakrti*. But in Samkhya, *buddhi* works only in connection with the soul (*purusa*), while in Uddalaka's materialism there is no *purusa*, no eternal soul as the ultimate and only subject."

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[65] Ruben SAIT 79-80.

Ruben refers here evidently to the later Samkhya. However, scholars as eminent as Sukhlalji Sanghvi and S.N. Dasgupta have already argued that there are grounds to think that even the Samkhya philosophy in its original form is presumably without a soul in the later sense. Admitting this, we have to look at Uddalaka's philosophy as strongly reminiscent of early Samkhya, though at the present stage of historical research it may be premature to try to be exact about the relation between the two, i.e. to determine whether in Uddalaka's view is foreshadowed the Samkhya or whether he gives an early version of the Samkhya. What is still more important is to note that Uddalaka is the first philosopher who offers positive proofs for the origin of consciousness from matter.

Such then, are the two ways of looking back at Uddalaka's view, and between the two there is all the difference between fiction and fact. One of these is based on the zeal of somehow or other casting the view into the mould of the spiritualistic-religious philosophy alleged to be the only philosophy of the *Upanisad*-s. The other is to see in him the scientist who, depending mainly on observation and experimentation, is trying to work out an explanation of the making of everything in the universe inclusive of the psycho-physical organization of man in terms of nature and nature alone.

In the Upanisadic age, the general drift of the spiritualistic-religious philosophy identifying the ultimate reality (*brahman*) with pure soul (*atman*)—the realization of which is alleged to be the royal road to salvation or *moksa*—is greatly patronized by the petty kings or nobles, called the Ksatriyas, if for no other reason than it ensures immortality for them and perhaps also absolves them of the sense of guilt for acts required of their despotism. As a matter of fact, a number of important modern scholars goes to the extent of branding this philosophy as but innovation of the Ksatriyas. In any case, the ancient law-makers or the authors of what is called the *Dharmasastra* soon decree that this is the only officially approved philosophy. It is done with so much of zeal that any trend of reasoning—and sometimes the very technique of reasoning which we call "logic" (*hetuvidya* or *anviksiki*)—in so far as it is not fully subservient to this philosophy—is declared to be a punishable offence.[66] A full analysis of why the kings and nobles and their political spokesmen, the law-makers, take so much of interest in this spiritualistic religious metaphysics is of course a complex one. In order to answer it, adequately, it is necessary to digress long into sociological analysis, which would be outside the scope of the present discussion designed mainly to identify the theoretical fundamentals of the first scientist in global history. In any case, it seems that in the society in which Uddalaka lives, the soil is not yet prepared to allow the seeds of nature-science to take roots. Hence, at least from the time of the *Brahma-sutra* or *Vedanta-sutra*—which is for us the earliest text wanting to show that the entire corpus of the Upanisadic literature contains only the *brahman-atman* metaphysics ensuring *moksa*—Uddalaka's science is subjected to the most tortuous distortions, as is done by the later commentators of it like Samkara and Ramanuja. In this way, Uddalaka, the scientist, is pushed to the background, in his own country and this in order to make room for an imaginary Uddalaka moving along with the same path as that of the officially boosted metaphysics supposed to ensure freedom from the fetters of the material world.

From this point of view, the real maker of nature-science does not have much impact on his immediate intellectual climate. However, this may not be the whole story. Something, it seems, is also going on, though under the surface. Uddalaka's methodology and perhaps also his suggestion of the environmental matter interacting with body-matter (i.e. matter going to the making of man) seems to have its impact on the formation of Indian medicine called Ayurveda, which presupposes the momentous step being taken from the system of magico-religious therapeutics (*daiva-vyapasraya bhesaja*) to the system of rationalist therapeutics (*yukti-vyapasraya bhesaja*). How far this is directly or indirectly inspired by the earliest step to nature science taken by Uddalaka Aruni is, of course, still a matter of intensive research. But such a possibility cannot be easily ruled out. Our ancient medical literature shows in many a way the flowering of the seeds originally sown by Uddalaka. From this viewpoint, we may conclude that the achievements of our first scientist is not completely stamped out by the process of persistent distortions of it for centuries ; these continue to work, though under the surface, to inspire the formation of some of the basic features of our rationalist medicine. But more of this later.

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[66] E. g. *Manusmrti* iv. 30 etc.

CHAPTER 8

FROM MAGIC TO MEDICINE

1. PRELIMINARY REMARKS

We have so far seen how the literary products of the Second Urbanization give us glimpses of the preparation in various ways of the soil for the growth of natural science. We have also seen how all these reach a remarkable result in the view attributed to a certain Uddalaka Aruni : the convergence of a number of new significant suggestions in his view makes us inclined to look back at him as the first scientist in global history.

From what comes down to us as recorded about Uddalaka, we have the impression that the knowledge acquired and systematized by him was but a satisfaction of an intellectual quest. Admitting this, we have to note further that the scientific knowledge in ancient India did not long remain so. It soon bore fruit in the form of man's power over nature. This is evidenced by medical science, the essential core of which took shape already before the Buddha[1] and therefore, if not at the time of Uddalaka, at least shortly after him. That it aspired to be an extension of man's power over nature is, of course, obvious. What requires to be noted, however, is that it owed a number of basic principles to the achievements of Uddalaka whose own interest in the problems of physiology is not washed away from what the *Brahmana*-s and *Upanisad*-s record about him.

The Indian word for medical science is Ayurveda, literally the science of the prolongation of life. But it is perhaps better translated as the system of *rationalist* medicine. The epithet "rationalist" is deliberately emphasized, for, in order to acquire the status of science proper, Ayurveda—we shall presently see—had to struggle hard to outgrow the earlier authority of magico-religious beliefs already sanctified by scriptures. This by itself is reminiscent of Uddalaka, whose starting point was to reject in a crafty manner the futility of the study of the scriptural lore, even though it is acquired over a period of twelve full years.

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[1] The dating of the formation of the essentials of rationalist medicine will be discussed in *Appendix* VI.

But Uddalaka's influence in the formulations of Ayurveda was not confined to this. Many of the fundamentals of his teachings are discernible behind its formation. After showing in his own way the futility of remaining crammed within the scriptural declarations, he passed on to the concept of causality. No enquiry into nature could be meaningful without first being clear about it. Rationalist medicine, too, insists that the causal principle constitutes the first and essential one for medical science.

The way in which this is emphasized in Ayurveda requires a few words of explanation. The *Caraka-samhita*, its main source-book, admits that various medical systems are no doubt in circulation in the world : *vividhani hi sastrani bhisajam paricaranti loke* (iii.8.3).[2] Apparantly, during the formative period of rationalist medicine, different authorities were groping in different ways for determining the most effective therapeutic principles : various avenues had to be explored for medical science to be standardized. Different medical systems having been thus recognized, the need was also felt for admitting each system having some characteristic principles of its own, which our text calls *prati-tantra-siddhanta*. At the same time, it insists that there must be some essential principles without accepting which no study can be entitled to be called medicine at all (*sarvatantra-siddhanta*).

What, then, are these basic principles for medicine as such ? While answering this, the first point emphasized by the *Caraka-samhita* is the principle of causality. As the text says, *santi nidanah*, 'the cause exists', which means there must be a definite cause of everything. We can thus understand why this grand medical compilation should have an entire book bearing the title Nidana-sthana, 'the book on the cause'.

The admission of everything in nature having a specific cause immediately raises another question : How is the cause to be determined ? It is, in other words, the question of the method of scientific quest. Here, again, it is not difficult to sense Uddalaka's pioneering work in science. As we have argued, Uddalaka has got to be admitted as the maker of natural science if for no

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2. Reference to the *Caraka-Samhita* are to the Gulabkunverba edition, Jamnagar, 1949 and to the *Susruta-samhita* to Kasi Sanskrit Series edition, Varanasi, 1972. Where the translation of the latter by Bhisagratna is used, it is abbreviated as B.

other reason than his contribution to the formulation of its method. The first precondition of his method is direct observation of facts. Though it remains for us to see how much of elaboration the discussion of the method acquires in the *Caraka-samhita*, it is of material importance to note that direct observation of facts is repeatedly emphasized in the medical work as the first precondition of a sound scientific method. Just one example of this may be mentioned here. Wanting to prove that life is nothing but food transformed into life (*pranah pranabhutam annam*), the text says, "The specialists assert that the phenomenon called life of those things that are known as living beings—i.e. of all creatures—is made of food and drink of desirable colour, smell, taste and touch, consumed in right manner. They assert this, *because of the results being directly observed* (*pratyaksa-phala-darsanat* : i.27.3).

All this, in short, is indicative of the assertion of the primacy of perception. Equipped with his method, Uddalaka went in for a commitment far too ambitious for his time. It was to develop an integrated view of man and nature and this on the basis of as essentially materialist hypothesis. The same forms the basic theoretical plank of Ayurveda and we shall see how much of richness of content it acquired driven mainly by the theoretical admission of matter being the ultimate stuff for everything in nature.

Indeed, rationalist medicine of ancient India cannot but amaze us by the richness of its empirical content. The way in which its founders conceived their essential problem did not allow them to remain confined only to such branches of knowledge as are generally assumed to be essential for medical science—like anatomy, physiology, pharmacology, etc. They found themselves obliged to digress into many other disciplines—understandably in their incipient forms—that later developed as various specialized sciences, like botany, zoology, physics, chemistry and even climatology and minerology. Besides, the need felt for the development and refinement of their method led the early doctors to an elaborate epistemology which, as we shall see, presumably anticipated the Nyaya philosophy. Similarly the zeal necessitated by the way in which they wanted to understand their essential task led them to aspire after a systematic understanding of nature as a whole, which they thought was best done in terms of a number of fundamental categories. To the students of Indian philosophy, these categories cannot but be reminiscent of the Vaisesika. In medical Science, in other words, there appears to be some kind of primordial bond between the Nyaya and Vaisesika views, making it easy for their eventual reamalgamation as the Nyaya-Vaisesika philosophy.[3]

Rationalist medicine of ancient India has thus more interest than therapeutic technique in its restricted sense. We can perhaps better put the point by asserting that the need felt for a really adequate understanding of the therapeutic technique itself led the founders of Ayurveda to broaden their scope of enquiry so much as to include the promise—though in their embryonic form—of a considerable number of other branches of natural science and even of science-oriented philosophical views.

Any survey of Ayurveda, even in its bare outlines, is thus bound to have a considerable number of dimensions. The scope of our present study will keep us confined only to a few of these —specially to those that are immediately relevant from the viewpoint of the theoretical fundamentals of natural science. Since, at the same time, we are required to understand the historical continuity of the intellectual climate of ancient India, we have started with the new quests ushered in by the Second Urbanization. Howsoever remarkable the achievements of rationalist medicine may appear, we may as well note that it did not come into being like Minerva, as it were, fully attired. We have also to understand the sub-soil that nourished it and when we proceed to do so we cannot but be led to see the intellectual turmoil created by the Second Urbanization, which gave to the cultural heritage of India such a remarkable scientist as Uddalaka Aruni.

2. ON THE SOURCES OF AYURVEDA

But let us first have a brief idea of the sources of our knowledge of Ayurveda. The Indian tradition speaks of three major source-books, figuratively called the *vrhat-trayi* or 'the three great ones'. These are the *Caraka-samhita, Susruta-samhita and Astanga-samgraha.* There exist also a considerable number of commentaries on these and many of their digests. We are in possession moreover of some fragmentary—but on the whole early—medical works, like the so-called *Bower Manuscript* and *Bhela-samhita*. What come down to us as the *Kasyapa-samhita*, *Harita-samhita*, etc., though bearing the names of some ancient authorities, are not really ancient works.

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[3] See *Appendices* VII & VIII.

All these other works have at best occasional and incidental lights to throw on ancient Indian medicine. But the *vrhat-trayi* remains the most basic sources of our information of it. Of these, again, the *Astanga-samgraha* is more in the nature of a medical manual prepared by a famous physician called Vagbhata (*c*. A.D. 200-300) who undoubtedly depends on the *Caraka-samhita* and *Susruta-samhita*. Without undermining its importance, therefore, it would be wrong to consider it to be as basic as the other two. Of these two, again, the primary interest of the *Susruta-samhita* is surgery, though on the whole it shares the doctrinal content of the *Caraka-samhita* and accepts the drugs and diets prescribed by the latter. At any rate, the *Caraka-samhita* remains most important for understanding the theoretical position of Ayurveda, though for the purpose of a fuller view of this, it is necessary to refer rather frequently to the *Susruta-samhita*.

We shall have here some rough idea of these two texts.

3. THE *CARAKA-SAMHITA*

The *Caraka-samhita* is an enormous medical compilation, parts of which are entirely in verse, parts in prose alternating with verse, parts simply in prose often concluding with mnemonic verses. Its language, as Filliozat[4] says, "is classical and does not correspond to a definite epoch." On a rough calculation, it is about three times in bulk of what survives as the medical literature of ancient Greece, the so-called Hippocratic corpus.

The text contains 120, or, counting the sub-chapters on Rasayana (alchemy) and Vajikarana (aphrodisiacs) 126, chapters in all. These are arranged in eight books, namely :

1. Sutra-sthana, discussing in 30 chapters the history, general principles, theoretical basis, etc. of medical science.
2. Nidana-sthana, intended to discuss in 8 chapters the causes of various diseases and their symptoms.

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[4] J. Filliozat 50.

3. Vimana-sthana, discussing in 8 chapters a wide range of assorted topics, like the nature and qualities of matter, the process of transformation within the body of various natural substances consumed, the method of medical science, codes of conduct of the medical practitioners, etc.
4. Sarira-sthana, intended to discuss in 8 chapters mainly anatomy and embryology, though as a matter of fact the chapters often also digress into metaphysics, ethics etc.
5. Indriya-sthana, discussing in 12 chapters various questions among which those concerning diagnosis and prognosis are prominent.
6. Cikitsa-sthana, discussing mainly therapeutics—hence also a great deal of dietetics and pharmacology—in 30 chapters (or, counting the sub-chapters of the first two chapters, 36 in all).
7. Kalpa-sthana, containing 12 comparatively brief chapters, supplementing the pharmacopoeia of the earlier books.
8. Siddhi-sthana, containing 12 chapters on enema, purgation, urinary diseases, etc., mainly supplementing what is discussed in the other books of the compilation.

A great deal of rigour is not maintained in the arrangement of the main subjects discussed in these eight books. The text as a whole is full of repetitions and digressions. It also describes debates and disputes among various authorities on questions of basic theoretical importance and, what is highly interesting, the text insists that such debates are extremely useful for expanding the mental horizon of the doctors. In any case, the *Caraka-samhita* is fully aware of the differences of opinion among practising doctors.

Such then is the general situation of ancient Indian medicine presupposed by the *Caraka-samhita*. However a number of minimum propositions for medical science as such are admitted. These are : (1) the principle of causality, (2) the recognition of the fact of disease, which seems to mean the acceptance of disease as a disease rather than as any supernatural phenomenon, and (3) the self-assurance of the doctor that there must be techniques of actually curing the diseases that are not incurable.

4. THE *SUSRUTA-SAMHITA*

The therapy recommended by the *Caraka-samhita* is based mainly on the use of drug and diet. It recommends surgery only in a few exceptional cases and even this perhaps somewhat reluctantly.[5] By contrast, the *Susruta-samhita* wants emphatically to argue the primary importance of surgery in medical science. "All hold this tantra (*salya-tantra* : surgery) to be the most important of all the other branches of Ayurveda, inasmuch as instantaneous actions can be produced with the help of such appliances as surgical operations, external applications of alkalis, cauterization etc., and secondly, it contains all that can be found in the other branches of the science of medicine as well, with the superior advantage of producing instantaneous effects by means of surgical instruments and appliances. Hence it is the highest in value of all the medical *tantra*-s." (i.1.15.B)

Compared to the *Caraka-samhita*, the *Susruta-samhita* is somewhat lesser in bulk. Like the former, however, it is also written in classical Sanskrit, partly in verse and partly in prose. The main body of the text contains 120 chapters arranged in five books.

These are :

1. Sutra-sthana, discussing in 46 chapters various topics inclusive of the general principles of medicine, the use and construction of surgical appliances, practice of surgery, cauterization, etc.
2. Nidana-sthana, discussing in 16 chapters mainly the causes of diseases.
3. Sarira-sthana, discussing in 10 chapters mainly anatomy, embryology and the dissection of the corpse.
4. Cikitsa-sthana, discussing in 40 chapters therapeutic techniques.
5. Kalpa-sthana, discussing mainly toxicology in 8 chapters.

To this main body of the text is added, evidently later, an appendix in 66 chapters on assorted topics, which is called the Uttara-tantra or 'postscript to the treatise'.

We shall have a few more words on these helpful for our understanding of the theoretical fundamentals of Ayurveda.

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[5] vi. 5.44 ; vi. 5.63 ; vi. 5. 137-40 ; vi. 6.58 ; vi. 13. 184 ; vi. 26.68 ; vi. 26.123 etc.

5. ON AUTHORSHIP

First, the *Caraka-samhita* on which the present study is specially based.

As for its possible date, modern scholars have proposed various views. These range from the 6th century B.C. or much earlier to the 1st century A.D. or much later. We shall have to reopen this question later and see that though any tendency at absolute dating of the text is bound to be fallacious, there are important evidences suggesting the formation of what Filliozat calls "the epoch of the creation of the doctrine contained therein".

There, however, remain a considerable number of other points to be first clarified about the actual doctrinal content of the Ayurvedic texts. The form in which these come down to us contains a great deal of counter-science superimposed on science, leaving us with the problem of not only identifying their scientific core but also that of the motivation of superimposing on it of a huge heap of palpably alien ideas and attitudes. Let us have here some idea of the formation of the source-books of Ayurveda which may throw some light on this peculiarity.

The medical tradition embodied in the text is admittedly ancient. But the only form in which it reaches us is quite late. After passing through various hands, it receives its present form from one Drdhabala, who calls himself its final "reconstructor" (*pratisamskarta*). What he tells us of the history of the formation of the work, shorn of mythologies, has something to tell on its extant form.

The work begins with the account of a conference convened somewhere in the Himalayas. It is attended by a fairly large number of ancient sages, disturbed by the fact of human suffering caused by various diseases. Could this be a way of stating the simple fact that the original core of the work represented an effort to create a general pool of medical knowledge, which remained scattered among various doctors of different localities before the attempt at a systematic compilation of these was made at a congregation of doctors ? But the text itself does not say anything about genuine medical questions being discussed in this grand assembly. It is more interested in telling us a transparent fiction : one of these sages goes to heaven and obtains the knowledge of medicine from Indra, the king of gods, who, in his turn, receives it from Brahma, via Prajapati and the Asvins.

In this garbled account of the descent of medicine from heaven to earth, one point appears to be quite striking. The earliest human authority on Ayurveda, according to our text, is a person called Bharadvaja. Interestingly, the text does not attribute to him any discourse on disease and cure. He is interested instead in the theoretical foundations of Ayurveda, which are very cryptically formulated as six categories—the 'similar' (*samanya*), dissimilar (*visesa*), qualities, substances, action and inherent relation : *samanyam ca visesam ca gunan, dravyani karma ca/samavayam ca*...... i.1.28-29). In the history of Indian philosophy, we come across these categories in the Vaisesika system, in which specially the first two acquire altered significance. But the more important point is that these categories are absolutely essential for the theoretical basis of Ayurveda, because only in terms of these that an enormous amount of empirical data, specially about the therapeutic agents, compiled presumably by generations of observers, are sought to be processed or systematically understood by the ancient Indian doctors. Could it thus be that the *Caraka-samhita* retains in its own way the memory of the earliest theoretician of the medical school ?

But Bharadvaja is a common *gotra* or clan name. Nothing of positive historical value can be made of the assorted legends associated with it in the epics and mythological literature (*Purana*-s). But what we read about him in the *Caraka-samhita* itself is peculiarly interesting. Though admitting him to be the first human authority (or perhaps the earliest theoretician) of Ayurveda the text seems to maintain a polite silence about him in its account of the transmission of medical knowledge. Thus the pioneer Bharadvaja notwithstanding, the extant *Caraka-samhita* makes another sage called Atreya—evidently also known as Punarvasu—the main spokesman of medicine. The entire *Caraka-samhita* claims to be based on the oral instructions of Atreya. Modern scholars like Filliozat[6] and Keswani[7] want to take it for granted that Atreya in his turn is instructed by Bharadvaja. But the text itself does not say this. It simply drops Bharadvaja and begins anew with Atreya and his pupils.

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6. J. Filliozat 60.
7. H. H. Keswani 10.

Why is this peculiarity? We have perhaps a clue to it elsewhere in the *Caraka-samhita*. Bharadvaja is a staunch advocate of the view traditionally known as *svabhava-vada*.[8] This view is considered strongly heretical specially in the later intellectual climate of the country and one of the ways in which the extant *Caraka-samhita* wants to look very pious is to introduce a long discourse into the text with the ostensible purpose of converting Bharadvaja[9] into a follower of orthodox religion and metaphysics. This, as we shall later see in some details, is an extremely interesting internal evidence of the *Caraka-samhita*, indicative of the anxiety at an ideological shift on the part of those through whose hands the text passes before reaching us. The only way of ignoring or overlooking the possibility is to imagine—as some modern scholars actually do—that the text mentions different Bharadvajas. But there is nothing in the text to support this. Besides, the more important question remains whether the theoretical fundamentals of Ayurveda can at all do without the view of *svabhava*. We shall see that these cannot; the assumption of laws inherent in nature is not a dispensable proposition for ancient Indian medicine.

But let us return to the *Caraka-samhita* as finally "reconstructed" by Drdhabala. In this, as we have just said, the exponent of medicine is supposed to be Atreya. His oral discourse, we are further told, is codified by his foremost disciple called Agnivesa.

Thus the typical form in which a chapter opens is: "Thus spoke the exalted Atreya" (*iti ha sma aha bhagavan atreyah*). And the usual colophon at the end of each chapter reads: "Thus in this treatise made by Agnivesa. . ." (*iti agnivesa-krte tantre. . .*). In other words, we are asked to believe that this enormous work is based on the oral discourse of one person, subsequently codified by only one of his students. Whoever may be responsible for trying to create such an impression, there are certain *prima facie* difficulties about it. The work is of the nature of a compilation or *samhita*. In spite of the rather mechanical form maintained practically throughout the extant text that it is nothing but Atreya's discourse codified by Agnivesa, there are places in which its editors or reconstructors appear to forget it. We shall mention here only three examples of this from the extant *Caraka-samhita*.

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[8] i. 25. 20-21.

[9] iv. 3. 16 ff.

First, as we shall presently see, on Drdhabala's own admission, a considerable number of chapters are added to the book by himself. Peculiarly, however, even these chapters open with the stereotyped declaration: "Thus spoke the exalted Atreya". Such a declaration is thus no more than a matter of mere formality.

Secondly, the eleventh chapter of the Sutra-sthana opens as usual with the statement that it is spoken by Atreya. But the mnemonic verse quoted at its end attributes the discourse in it to "the wise Krsna Atreya" (*Krsnatreyena dhimatam*).[10] Are we then to think that the text refers to the same person alternatively as Atreya and Krsna Atreya? But that is not very easy. Apart from the fact that the *Caraka-samhita* itself attributes a number of recipes evidently to a different medical authority mentioned as Krsna Atreya,[11] later Indian medical tradition insists, as Mukhopadhyaya[12] shows, that Krsna Atreya "belonged to the surgical school and could not have been the same as Punarvasu Atreya" or the alleged spokesman of our *Caraka-samhita*. Incidentally, the chapter referred to is itself a rather quaint one. Its earlier part (up to i. 1.33) is more interested in orthodox religion and metaphysics apparently oblivious of the medical requirements. The latter part of the chapter, however, is outspokenly medical in content, recognizing—which is somewhat unusual for the *Caraka-samhita*—surgical excision as a form of therapy equally important as medicine (i. 11.55).

Thirdly, in view of the fact that one cannot wilfully alter the proper name of an ancient and eminent authority depending on the meaning it conveys, we are sometimes left to wonder about the real personality of Agnivesa from the standpoint of the extant *Caraka-samhita*. Though used as a proper name practically throughout the work, at least on two occasions the text follows the extraordinary procedure of concocting synonyms for it based on its literal meaning. Thus the same authority is also mentioned as Vahnivesa (i. 13.3) and Hutasavesa (i, 17.5)—both with the literal meaning of *agnivesa* or "one with fire garment", and, at least in the first case, even without any need for rhyming. Does this mean that *Agnivesa* is taken more as a descriptive epithet than the proper name of an individual authority? Or does it mean that the very assumption of a single person codifying the vast medical compilation is more of the nature of an afterthought and hence forgotten by the editors in their unguarded moments?

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[10] i. 11. 64.

[11] vi. 15. 131 ; vi. 15. 185 ; vi. 16.17 ; vi. 26-227 etc.

[12] G. Mukhopadhyaya ii. 440.

We have mentioned all these only to emphasise one point. It is hard to believe that the vast compilation with all its inner complexities is based on the oral instructions of a single person codified by only one of his students. The simple fact on the contrary seems to be that it contains the real pool of medical knowledge of a considerable number of ancient doctors and, what is most important for our understanding of it, it passes through various hands before reaching us in its present form. Who then are the ancient doctors, the compilation of whose knowledge and experience seems to form the original core of our *Caraka-samhita*?

6. ON "CARAKA"

What we have so far discussed about the formation of the work throws no light whatsoever on a point of very great importance. In Indian tradition, the text firmly acquires the name *Caraka-samhita,* literally Caraka-compilation. How are we to explain this? The only answer given to it by the work in its extant form is too thick to be seriously taken. Caraka, we are told, was some kind of an intermediate editor or reconstructor of the work, which, in its present form, is finally reconstructed by Drdhabala. The story, in short, is that the work is originally expounded by Atreya, codified by Agnivesa and revised by Caraka, i.e., already before it reaches Drdhabala.

Caraka's name thus occurs in the text only in its chapter colophons, which read *agnivesa-karte caraka-pratisamskrte*—"made (codified) by Agnivesa and revised by Caraka". Assuming this—assuming in other words, that Caraka is only an intermediate editor of the work—his role in its formation can only be secondary. Why then—in spite of Atreya and Agnivesa—the work should acquire fame as the *Caraka-samhita?* Secondly, Drdhabala wants us to believe no doubt that Caraka is the proper name of an individual authority with extraordinary intellect (viii. 12.67-8). But it is extremely doubtful if the word *caraka* can be taken as the proper name of an individual authority. It literally means "the roving one". In ancient India, it is usually used as the descriptive epithet of many wandering sects, which were then quite common.[13] Such sects could as well include those of the roving physicians, the historical existence of which is evidenced by the name of a lost recension of the *Atharvaveda,* called *Carana-vaidya* or "roving physicians".[14] Besides, according to the Indian medical tradition itself, of the various trainings required of being a physician, one is called "roving about",[15] apparently because the search for the healing agents requires it. Thus, in short, the name *Caraka-samhita* becomes hardly convincing if Caraka is taken to be the proper name of just an intermediate editor of the text. It seems to make far better sense if viewed as the compilation of medical knowledge of the ancient roving physicians. Could it be that because of the Brahmanical taboo against the practice of wandering about—a practice that created difficulties for the observance of the various rituals prescribed in the law-books[16]—the word *caraka* is sought to be converted into the proper name of an individual, who is somehow connected with the medical corpus, though only in the capacity of being its intermediate editor ?

It may as well be noted here how the assumption of Caraka having been an individual authority contributed to an illusory assurance concerning the date of the vast compilation.

The majority of modern scholars are inclined to place the medical compilation in the first century A.D. The most important evidence on which they depend is summed up by Filliozat[17] as follows : "Certain Buddhist texts in Chinese talk of a certain Tche lo kia or Tche le, i.e. Caraka or Cara, who was the doctor of King Kaniska. This fact has been simultaneously recognised by Sylvain Levi and by Takakusu". Kaniska's date being known to the historians, this evidence of Caraka having been his court physician is supposed to remove the uncertainties about the date of the *Caraka-samhita*.

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[13] Rhys Davids in JRAS 1898 ; C. Bendall in JRAS 1901.

[14] S. N. Dasgupta ii. 283-84.

[15] P. M. Mehta 241.

[16] G. Grierson in ERE x. 570.

[17] J. Filliozat 16-17.

But what exactly is the importance of the evidence so much relied upon? Filliozat has already answered the question. The Chinese sources mentioning Kaniska's physician are two. One of these is the translation of an anthology of tales. In Chinese translation, its title reads *Tsa pao tsang king*, suggesting the original Sanskrit title *Samyukta-ratna-pitaka-sutra*. The date of its Chinese translation is about A.D. 472. "It refers only to the friendship of Kaniska for his doctor who by his advice keeps him protected from all diseases".[18] The title of the other work, in Chinese, is *Fou fa tsang yin yuan tchouan*. Though it also claims to be a translation into Chinese, "H. Mespero has shown that the work in its present form is a forgery, composed in China on the lines of other works, towards the middle or end of the VIth century".[19] This work described "the relations of Caraka and Kaniska, the former himself offering his services as a doctor to the king, and by means of clever obstetrical moves, twice saving the queen on her death-bed while in the throes of delivery, leaving the king who did not pay much attention to his advice and retiring from the world".[20]

There is thus no question of attributing a great deal of historical importance to what is said in this second source. As for the first, Filliozat observes, "It is true that the *Tsa pao tsang king*, translated in Chinese only about three hundred years after the reign of Kaniska, existed in Sanskrit before and had, therefore, been composed at a date quite near to that of Kaniska. The memory of the real contemporaries of this prince could have been faithfully preserved till then and, in any case if it were the question of a more recent author, the Caraka in question could not have lived a long time after the 2nd century."[21]

However, admitting that this other source is more reliable, what exactly can it prove about our *Caraka-samhita*? Filliozat rightly comments, "even if the doctor of Kaniska was effectively called Caraka, we are not certain that he was the same Caraka who has revised the *Agnivesa-tantra*"[22] or our medical compilation.

[18] *Ibid.* 17.

[19] *Ibid.*

[20] *Ibid.* 17-18.

[21] *Ibid.* 18.

[22] *Ibid.*

The more important question which Filliozat seems to ignore in the present context is concerning the credibility of Drdhabala's statement about Caraka. This credibility is very low, because it is extraordinarily strange for Indian tradition to remember a work by the name of one whose contribution to it is secondary after all. On the other hand, as we have already noted, the word *caraka* seems to be a general descriptive epithet of a number of wandering sects of ancient India. Thus, the *Caraka-samhita* could as well mean the medical compilation of some sect of the ancient roving physicians, whatever may be the subsequent history of processing this compilation. From this point of view, there is nothing improbable about a doctor belonging to such a sect being attached to Kaniska's court, as is perhaps indicated by the Chinese sources. However, even admitting the connection of a certain *caraka* with Kaniska, Kaniska's date cannot have much relevance for the dating of our medical compilation.

In any case, at the present stage of research any attempt to date the medical compilation depending on the word *caraka* would at best be precarious. Also conjectural would be the effort to fix the date of Atreya or Agnivesa, because it is not easy to salvage anything of sound historical significance from the legends about them.

7. ON DRDHABALA

For the present, however, let us see a little more about what Drdhabala has to say about the *Caraka-samhita*.

What actually comes down to him is Agnivesa's version of the text as already edited or revised by an intermediate editor, whom he is pleased to call Caraka. From what Drdhabala says, we can form no idea of the possible time-gap between Agnivesa's original codification of it and its subsequent revision by Caraka. But the time-gap between this intermediate editor and Drdhabala—its final reconstructor—must have been considerable, because Drdhabala says that during his own times about one-third of the work "codified by Agnivesa and revised by Caraka" becomes extinct. We do not have any explanation of this from Drdhabala. He simply tells us that he takes upon himself the responsibility of writing out these lost portions, which to be exact, consist of 41 out of the total 120 chapters. As he puts it :

"In this work of Agnivesa as revised by Caraka have not survived seventeen chapters (of the Cikitsa-sthana) and also (the whole of) the Kalpa(-sthana) and Siddhi(-sthana). For the purpose of properly completing it (*yathatatham puranartham*), these are written by Drdhabala, son of Kapilabala." (vi.30.288-90)

Elsewhere, towards the end of the Siddhi-sthana, Drdhabala explains the nature of his own contribution to the extant *Caraka-samhita* in more detail. He says,

"For the welfare of living beings were composed one hundred and twenty chapters by the wise Agnivesa containing the words of sage Atreya...... *The editor creates anew an ancient treatise*, amplifying for this purpose what is cryptically said and condensing what is said much too elaborately. Since one-third of this work as revised by Caraka with incomparable intellectual accomplishment was found missing, it is completed by Drdhabala, who is born in the town of Pancanada (*pancanadapura*), after propitiating Samkara (Siva), the lord of all creatures. He has completed this treatise by adding to it seventeen chapters on therapeutics, the Siddhi-sthana and Kalpa-sthana and for this purpose *has collected the distinctive propositions from a very large number of other treatises*." (viii.12.34-93. Emphasis added).

Let us first try to be clear about the information we have of Drdhabala the person in the two passages just quoted. He is born in the town called Pancanada and his father's name is Kapilabala. Apparently he belongs to a very famous family of physicians, because Vagbhata mentions his father Kapilabala as having medical theories of his own.[23] The question of the geographical location of Pancanada town is extensively discussed by the modern scholars, who propose to view it as an old name of a town in Kashmir somewhere near the confluence of the Jhelum and the Sindhu.[24] Drdhabala thus belonged to Kashmir.

As for the possible date of Drdhabala, the modern scholars are left to conjecture on the basis of the reference by him to other authors or the reference to him or to his work by other authors—a procedure which, though not very satisfactory, is often the only one open before them for the purpose of dating literary

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23. *Astanga-samgraha* Kasi ed. i. 20.
24. A.F.R. Hoernle in *JRAS* 1908. 947 ff; 1909. 817 ff.

sources. Depending roughly on such a procedure, it was earlier suggested by A. B. Keith, for example, that Drdhabala possibly belonged to the eighth on ninth century A.D.[25] But Mehta[26] argues that since Vagbhata's work is indebted to an appreciable extent to our *Caraka-samhita* which shows no awareness of Vagbhata's work, and since there are no grounds to think that Vagbhata cannot be later than the 4th century A.D., we have to put Drdhabala somewhere between the end of the 3rd century and the earlier part of the 4th century. What makes this view really questionable is the assumption of Vagbhata's date, the only substantial evidence in favour of which is Mehta's claim that the astronomer Varahamihira mentions Vagbhata. But Varahamihira belongs to the sixth century and there is nothing impossible for a scientist to refer to his contemporary. Priyavrata Sharma[27] in fact argues that Varahamihira's reference to Vagbhata notwithstanding, Vagbhata himself is strongly indebted for his astronomical calculations to Varahamihira. In any case, we are yet to settle the date of Vagbhata and hence it is risky to try to settle Drdhabala's date on the assumption that Vagbhata is aware of the *Caraka-samhita* in the form in which it is finally "reconstructed" by Drdhabala. On a very rough estimate, however, it may perhaps be permissible to assume that he belongs to the late Gupta period or sometime near the sixth century.[28]

More important for our understanding of the extant *Caraka-samhita* is to note certain other points. On Drdhabala's own admission, he not only writes 41 missing chapters of the text but moreover rewrites its surviving 79 chapters depending for the purpose on various other treatises. This, to say the least, must have been a stupendous intellectual performance and we cannot but he amazed at it. At the same time, we cannot overlook the possibility of the text suffering very serious alterations from whatever little he says about the history of its formation. If there are difficulties in accepting his statement that Atreya is the sole exponent of this vast medical compilation and Agnivesa alone codifies the whole of it, there is no ground to imagine that these names are totally fictitious. The presumption on the contrary is that these are names of eminent ancient authorities through whose hands the compilation passes before reaching its intermediate editor before Drdhabala. We do not know if the earlier authorities add to or alter the work at all. But the possibility of this intermediate editor seriously altering the text cannot be ruled out, because, according to Drdhabala, that forms part of the editorial responsibility of the "reconstructor". As he puts it, *samskarta kurute tantram puranam ca punah navam* (viii. 12.37)—"the reconstructor creates anew an ancient treatise".

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[25] A. B. Keith HSL 506.

[26] P. M. Mehta i. 100 f.

[27] P. Sharma 156.

[28] *Ibid.*

Even dismissing all this as conjectural, there can be no doubt that at least Drdhabala follows his own editorial norm while rewriting two-thirds of the *Caraka-samhita* that comes down to him and he has scope for even greater liberties while writing out the other third of the work, which he frankly acknowledges to be his own. The possible effect of all this is to be judged in the light of two other considerations.

First, Dadhabala is anxious to pledge loyalty to a religious faith. He propitiates Siva or Samkara, the Lord of all Creatures, with whose blessings he manages to complete the work (viii. 12.38). It may be impossible for us today to judge the real depth of this religious conviction. In any case, it seems impossible to reject one possibility. We have in this loyalty to religion pledged by the final "reconstructor" of the work a possible clue to the religious elements found in the *Caraka-samhita* not easily reconciled with astute science.

Secondly, for "creating anew an ancient treatise", Drdhabala feels the need of depending on various other treatises, evidently inclusive of those that discuss alien subject-matters. He completes the work, as he puts it, "by collecting distinctive propositions from a large number of other treatises": *krtva bahubhyah tantrebhyah visesa-uncha-sila-uccayam* (viii. 12.39). Could it be so that such "other treatises" include non-medical works ?

If so, the result of all this must have been devastating. When a person with a professed religious conviction proposes to create anew an ancient work on medicine depending on the declared policy that it is desirable for the purpose to depend on all sorts of treatises, there is the obvious risk for the work as a whole assuming the form of a jumble of science and superstition. And the fact is that the *Caraka-samhita* does assume such a form. We may not know with certainty how much the work suffers this fate in the hands of those through whom it passes before reaching Drdhabala. This much is fairly obvious however that Drdhabala does not allow it to reach us without a great deal of grafts of alien ideas and attitudes on it.

At the same time, there is another point which must not be overlooked in this connection. Drdhabala's personal religious conviction might have been largely responsible for the text to assume the form of a queer amalgam of science and its opposite. It will however he an oversimplification to view this as the result of mere personal fad of the final redactor of the text in its present form. A much more important factor was there that necessitated the imposition of the orthodox religious norm on the scientific essence of the text. The real makers of the fundamentals of rationalist medicine, as we shall see, wanted to be too severely scientific to be tolerated by the law-givers, who, for the purpose of policing the people, felt the need of a mass of superstitions to be accepted by all. Hence in the strong condemnation of medical science by the law-makers, the details of which would be taken up by us in a separate *Appendix* as also the possible mode by which their censorship was sought to be evaded.

8. MEDICINE AND ORTHODOX PIETY

Filliozat comments on "the extremely brahmanic contents of the *Caraka-samhita*", which, as he rightly says, "evoke the idea that its editor was····a Brahmin of a Vedic school".[29] This, if somewhat uncertain of the intermediate editor referred to by Drdhabala, seems to be more or less certain about Drdhabala himself, only whose version of the text we are aware of. Keswani, however, makes a suggestion, which amounts to a possible way of looking at the ancient medical views without the religious bias added to these. It is to depend more on the other medical compilation, the *Susruta-samhita*. Both the compilations, he says, "on the whole, have similar contents, analogous divisions, and corresponding theoretical and practical data".[30] In spite of this similarity, however, Keswani thinks that the *Susruta-samhita* is surprisingly free from the priestly bias superimposed on medicine.

[29] J. Filliozat 21.

[30] N. H. Keswani 12.

As he puts it, "Charaka, in his writings, has a combined role of a moralist, philosopher and above all a physician; whereas, Sushruta has tried to cast off whatever shackles of priestly domination remained at his time, and created an atmosphere of independent thinking and investigation, which later characterized the Greek medicine".[31]

Without complicating matters by bringing in the question of Greek medicine at this stage of our discussion, let us concentrate here only on one point, which is immediately relevant for understanding the source-books of Indian medicine. If the true doctrinal contents of the two compilations are on the whole the same, as Keswani admits, and if the *Susruta-samhita* is totally free from the "shackles of priestly domination", as he further claims, the simple procedure to see the medical views without the priestly bias superimposed on these would obviously be to rely more on the *Susruta-samhita.* But the problem of the historian of Indian science is not so easily solved, because the alleged scientific purity of the *Susruta-samhita* is only an illusion. The fact on the contrary is that the only form in which this other medical compilation reaches us is not free from the priestly or Brahmanical bias. Indeed the priestly bias grafted on the *Susruta-samhita* sometimes creates worse confusions for us than does the *Caraka-samhita.* We shall mention here only one example, showing how the text in its present form goes to the extent of making the role of the physician and surgeon abjectly servile to that of the priests. Says the *Susruta-samhita* : "Ayurveda with its eight sections is revealed by (god) Brahma as a discipline subsidiary to the Veda. Hence the doctor, aware of his own role, must act in subservience to the priest (because the latter is the custodian of the Veda)". (i. 34.8).

This leaves the doctor with little or no confidence in the intrisic efficacy of his own knowledge and technique—a confidence which all the priestly bias added to the *Caraka-samhita* cannot obliterate from it. Thus the *Caraka-samhita* declares : "The physician starting medical treatment in time and with proper medical knowledge—inclusive of the knowledge of the difference between the curable and incurable diseases—is absolutely certain to attain success". (i.10.7)

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[31] *Ibid.*

In this defence of the doctor's role, there is no trace at all of any tendency to submit to the priests and their scriptural lore. It obviously belongs to the hard core of medical tradition embodied in the *Caraka-samhita.*

Significantly, from this standpoint, the self-confident doctors compare themselves to the technicians—the cooks and potters—while the *Susruta-samhita* wants to ennoble the doctor's role with an insipid imitation of the priestcraft. Thus, according to the view fully shared by the two compilations, successful medical practice depends essentially on four factors—doctor, patient, medicine and nurse—of which the most important one is of course the doctor. But the ways in which the two compilations want to express this are quite different. The *Caraka-samhita* says :

> The physician, the drugs, the nursing attendant and the patient constitute the four basic factors of treatment. Possessed of the required qualities, they lead to the earliest cure of disease..... Of these four the physician occupies the chief place, being at once the knower (of diseases and drugs), the instructor (of the attendant and patient) and describer (of medicine and regimen). As the utensils, fuel and fire are to a cook in cooking, or as the terrain, army and weapon are to a conqueror in obtaining victory, so are the other three factors in relation to the physician in accomplishing the cure. Hence is the physician the foremost factor in treatment. As the clay, the rod, the wheel etc. are ineffective in the absence of the potter, so do the other three factors in the absence of the physician fail to accomplish the cure. (i.10.3)

But the same idea is sought to be conveyed by the *Susruta-samhita* with a very different analogy. It is the analogy of a sacrificial performance in which, of all the priests employed, the one called Adhvaryu is supposed to be the most important.

Thus :

> The physician, the patient, the medicine and the attendant (nurses) are the four essential factors of a course of medical treatment.... In the absence of a qualified physician the three remaining factors of treatment will prove abortive, like a religious sacrifice performed with the help of an Udgatr, a Hotr and a Brahman in the absence of an Adhvaryu. (i.34.15 and 17)

The passages just quoted are, however, not to be misunderstood. These are intended only to show that the form in which the *Susruta-samhita* reaches us is not free from priestly bias. In certain contexts in which the *Caraka-samhita* is refreshingly free from it, the *Susruta-samhita* shows this bias quite crudely. But this does not at all mean that the extant *Susruta-samhita* shows more of this bias. In many passages of the *Caraka-samhita*, science remains completely submerged under superstition, while in many passages of the *Susruta-samhita* the viewpoint of science is least tainted by superstition.

What we are trying to drive at is a simple point. A comparative assessment of the two texts from the viewpoint of the superimposition of supersition on science in these is not so important as the form itself in which both the compilations reach us. If the later editors or reconstructors of the *Caraka-samhita* feel obliged to concede to religion for the purpose of making the medical compilation sufficiently innocuous in the eyes of the law-givers, there is no reason to believe that those through whose hands the *Susruta-samhita* passes before reaching us do not feel the same obligation, specially because its hard medical core is the same as that of the *Caraka-samhita*. If therefore the *Caraka-samhita* somehow or other also preserves for us the criterion by which to differentiate the strictly medical from extra-medical ideas and attitudes in it, the same criterion—though not actually found in the *Susruta-samhita*—may be profitably used for making a similar critical assessment of it.

9. FORMATION OF EXTANT SUSRUTA-SAMHITA

Less is known about the history of the formation of the extant *Susruta-samhita*, which wants us only to believe that once upon a time a number of sages approached Dhanvantari, *alias* Divodasa, king of Kasi, who received Ayurveda from divine sources —Brahma via Prajapati, the Asvins and Indra. Dhanvantari imparts medical knowledge to these sages, and one of them called Susruta codifies his oral instructions.

But it is too much to believe that this enormous compilation embodying a vast amount of empirical knowledge is codified by a single person depending on the oral discourse of a single authority. In spite of Hoernle,[32] therefore, there is no sure ground proving the historicity of Susruta, which literally means "that which is well heard", or "one who has thoroughly learned by hearing". Filliozat comments, "The personage of Susruta not being historical, the *Susruta-samhita* shows itself to be not as the personal work of a certain Susruta, but as the anonymously edited manual of a school which had selected a Susruta for patron."[33] Besides, there is at least one definite ground to think that the *Susruta-samhita* also does not reach us in its early form. "We know," continues Filliozat, "by the very tradition of this school, that this manual has reached us after having been retouched at least once. The commentator Dalhana (XI-XII century A.D.) affirms in effect that Nagarjuna has been the 'reconstructor' (*pratisamskartr*) of the *Susruta-samhita*. Cordier has put forward the hypothesis that he has also completed the earlier text by adding thereto the last section which now forms part of the *samhita* and which is known as the Uttara-tantra, 'Last Section (of the Book)'."[34]

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[32] Hoernle *Osteology* 8.

This has given some of the modern scholars an imaginary assurance about the date of the present version of the work, for Nagarjuna is a very famous Buddhist philosopher of *c.* second century A.D. The later Buddhist tradition attributes to him not only profound knowledge in alchemy but also a very large number of works on assorted subjects. It is thus easy to imagine that he had great knowledge of medicine as well and hence could be the real reconstructor of the extant *Susruta-samhita*.

On critical considerations, however, such an assumption proves futile. The great alchemic knowledge of Nagarjuna is only a transparent fiction leisurely fabricated by the propagandists of the Mahayana and—apart from only a few texts—most of those attributed to him are spurious, trying to acquire authenticity by being associated with his name. Besides, there are philosophical and religious considerations which make it impossible to connect him with the *Susruta-samhita* as we have it, unless of course we are prepared to believe that for the purpose of editing the medical compilation he agreed to forget the fundamentals of his own philosophy and even renounce his otherwise intense sectarian affililiation to Buddhism. We shall discuss here only a few reasons explaining this.

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[33] J. Filliozat 11-12.

[34] *Ibid.* 12.

Nagarjuna is the founder or at least the first great exponent of the Madhyamaka philosophy, popularly known as Sunyavada. As a form of extreme idealism it is as much opposed to the fundamentals of natural science as a philosophy can possibly be. Nagarjuna shows the greatest zeal to prove the total unreality of nature or material world (*prapanca-sunyatva*) in favour of an indescribable absolute (*tathata* or *sunyata*) only mystically apprehended. Of the techniques followed by him for proving this, two are most prominent. These are : (1) the denial of causality and (2) the damnation of experience and reason as sources of right knowledge.[35]

Can a philosopher like this have anything serious to do with the medical tradition ? The answer is obvious and it must be in the negative.

Philosophy apart, Nagarjuna has a strong sectarian affiliation to Buddhist religion in its later form. But the religious ideas and beliefs superimposed on medical science by those who prepare the extant version of the *Susruta-samhita* are predominantly Vedic—i.e. *tirthika* or 'alien' in the terminology of the later Buddhists. The text not only opens with the claim of being only an *upanga* or 'subsidiary discipline' of the *Atharvaveda*, it recommends moreover in a considerable number of places the chanting of Vedic spells and invoking the blessings of the Vedic gods, prescribes the propitiation of the Brahmin to obtain his blessings and speaks of the desirability of performing Vedic sacrifice (*homa*) for medical purposes.[36] Ignoring completely the medical viewpoint, it even goes to the extent of describing how the major organs of the body and the main physiological functions are really controlled by the Vedic gods. Here is just one example:

> The tutelary god of intellection (*buddhi*) is Brahma. The god Isvara is the presiding deity of the sense of egoism (*ahamkara*); the moon god is that of the mind (*manah*); the quarters of heaven, of the ears ; the wind god is that of the skin ; the sun is that of the eyes ; the water is that of the taste ; the earth is that of smells ; the fire is that of speech ; Indra is that of hands ; Visnu is that of legs ; Mitra is that of the anus and Prajapati is that of the organs of generation. (iii.1.7.B)

Can one with Buddhist bias say all these ?

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[35] See Chattopadhyaya WLWD Chs. 2 & 3.

[36] See. e.g. i.5.12 ; i.11.6 ; i.19.19 ; i.29.12 ; i.29.27 ; i.43.3 ; iii.1.7 ; iii.2.28 ; also i.5.4 ; i.6.18 ; i.19.5 ; i.28.3 ; iii.10.2, and i.11.6 etc.

Some of our modern scholars have their theory of two Nagarjunas—one the Sunyavadin philosopher and the other a specialist in alchemy and medicine.[37] Assuming this, we may expect to identify the reconstructor of the *Susruta-samhita* with this second Nagarjuna. But then who is he and to what period does he belong? Some hope of answering this question is roused by the account of Indian science left by the visiting Central Asian scientist al-Biruni (973-1048), who travelled in Indian during A.D. 1017-1030. He mentions *rasayana* as "an art which is restricted to certain operations, drugs, and compound medicines, most of which are taken from plants. Its principles restore the health of those who were ill beyond hope, and give back youth to fading old age."[38] Though al-Biruni is himself extremely cynical about the scientific merit of *rasayana*,[39] he tells us: "A famous representative of this art was Nagarjuna, a native of the fort of Daihak, near Somanath. He excelled in it, and composed a book which contains the substance of the whole literature on this subject, and is very rare. He lived nearly a hundred years before our time."[40]

Are we then to look for our reconstructor of the *Susruta-samhita* in this Nagarjuna, who, on al-Biruni's authority, is to be placed roughly in the tenth century? There are many difficulties in doing this. The *Susruta-samhita* contains only four brief chapters on *rasayana*, the discussion of which in the *Caraka-samhita* is far more extensive. In any case, it cannot be described by a scientist like al-Biruni as a book merely on *rasayana*. Secondly, as Filliozat convincingly shows, our *Susruta-samhita* must have been in existence long before the tenth century. "Happily", says he, "we have elsewhere some indices of calculating the date when the text of the *Susruta-samhita* was finally fixed. The medical manuscript found by Bower in Central Asia, at Koutcha, and published by Hoernle, mentions Susruta, as also Atreya, Bhela and other authors. Hoernle has determined the date of this manuscript with a somewhat illusory precision, but which, from the point of view of palaeography, belongs to the period of the IV to VI-th centuries...... Elsewhere, the texts attributed to

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[37] S. K. De in HB i. 119-20 ; Venkata Ramanan 336.

[38] Sachau i. 188.

[39] *Ibid.* i. 189 ff.

[40] *Ibid.* i. 189.

Vagbhata, the *Astanga-samgraha* and the *Astanga-hrdaya-samhita* follow and eventually reproduce the *Susruta-samhita* as it has reached us...... The *Astanga-hrdaya* is quoted in the *Kitab-al-Fihrist* in Arabic, in 988...... One can, therefore, admit that in VII-th century at the latest, the *Susruta-samhita* had been fixed in its present form, having already been re-adapted by the 're-constructor'."[41]

It is thus difficult to accept that the specialist in *rasayana* whom al-Biruni mentions as Nagarjuna is the reconstructor of our *Susruta-samhita*. Who then is this reconstructor? At the present stage of research it seems impossible to answer the question with certainty. This does not mean that the commentator Dalhana simply fabricates the story of such a reconstructor. The presumption on the contrary is that the contents of the *Susruta-samhita*, showing the rather free tendency of grafting all sorts of religious and metaphysical ideas on medicine and surgery, indicate that this compilation has a history of formation somewhat similar to the *Caraka-samhita*. In other words, the present form of the *Susruta-samhita* unmistakably suggests that this medical compilation too is variously altered by one or more editors, who want to give it a religious stamp to make it acceptable to orthodoxy. One of these editors may have the name Nagarjuna.

Since however we have no positive information about the editor or editors of the extant *Susruta-samhita*, any view about the time when the compilation assumes its present form is bound to be more or less conjectural. The more important point for our understanding of the history of Indian science seems to be the possible age of the formation of the medical views it contains. But we need not raise this question separately, because the doctrinal content of the *Susruta-samhita* is on the whole the same as that of the *Caraka-samhita*. Discarding therefore the tendency to any absolute dating of either of the two compilations, we shall later try to discuss the more basic question concerning the formation of the medical doctrines contained in both.

10. ON PROBLEMS OF TEXTUAL ANALYSIS

From what is discussed above, it is obvious that we are confronted with some rather unusual problems concerning the theoretical fundamentals of ancient Indian medicine.

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[41] J. Filliozat 13-14.

There come down no doubt two source-books of it, both enormus in bulk. Still we cannot take everything contained in these on its face value as characteristic of the medical standpoint. We are obliged instead to raise the question : What is intrinsic and what is extrinsic to medical science in these source-books of Ayurveda in their extant forms ? Such a question immediately raises the further problem concerning the criterion for differentiating between the two. The criterion accepted for the purpose, if external to the texts, runs the risk of arbitrariness. Fortunately, however, we shall see we need not go outside the texts to determine it, for the texts themselves with all the confused mass of anti-science superimposed on science, somehow retain clear indication of the principles for indentifying that which is actually extrinsic to medical science, though grafted on the texts.

This, when established, would inevitably raise another question of considerable importance. What could have been the possible motive for grafting the elements on the hard core of medical science specially in the *Caraka-samhita* ? The personal religious convictions of those through whose hands the texts pass before assuming their present forms could no doubt be a factor accounting for the motive under consideration. However, as we shall see, the more important factor accounting for it is to be sought elsewhere—in the socio-political conditions of the country.

This point is in need of some clarification. The founders of Ayurveda wanted indeed to be too severely scientific to remain unnoticed by the establishment in defence of which elaborate legal literature was produced in the country specifying not only the norm of conduct for everyman but also the way of thinking or belief-system. The ancient Indian doctors, in defence of their science, felt obliged to flout rather recklessly such prescriptions. As a result, beginning from a considerably ancient period, the doctors and surgeons came under continuous condemnation of the law-makers and other spokesmen of the vested interests.

In such a circumstance, one way of evading censorship and damnation was to pay a heavy ransom to the demands of the powers that be and this by way of feigning the officially approved norm of piety. Hence the later authorities through whose hands the source-books of Ayurveda passed went on dumping all sorts of ideas and attitudes on the hard core of their science so that Ayurveda could somehow be made to appear as compatible with the officially approved norm of piety. How far such alien grafts eventually became a part of the make-belief of the later practitioners of Ayurveda is of course a different question. When it became so, medical science came obviously under the grip of decadance. But two points may as well be noted in this connection.

First, this way of evading the censorship of the law-makers was not confined to the case of the representatives of medical science. The visiting scientist al-Biruni[42] noted how basically the same phenomenon happened also in the case of astronomy. Thus the great Indian astronomer Brahmagupta, with full knowledge of the actual cause of the eclipses, opened his work on astronomy with an apparently vigorous defence of the mythologico-religious view of the causes of the eclipses embodied in the scriptural and legal literature flatly going against his own scientific understanding of the phenomenon—an understanding on which Brahmagupta's own remarkable and subsequent astronomical calculations were based. Saving science in the later scripture-dominated climate of the country was indeed not an easy proposition.

Secondly, the Indian law-makers and other spokesmen of the establishment whose censorship was sought to be evaded by the ancient doctors and surgeons were Brahmanical by religious conviction. Outside the pale of the influence of Brahminism therefore this mode of saving medical science was not felt. This was specially conspicuous in the case of the Buddha and his followers. Hence in early Buddhist literature we have glimpses of ancient Indian medicine without any dent on it made by the demands of Brahmanical orthodoxy.[43] Besides having its immediate importance on our present point, the evidences about medical science recorded in the early Buddhist literature have the additional value of throwing light on the dating of formation of the theoretical fundamentals of medical science in ancient India.

All these may appear to be but bare conjectures. But before the readers feel inclined to take such a view they may as well go through the *Appendix* in which an attempt is made to substantiate all these with adequate textual data. The considerations leading us to barely mention the points here are purely of procedural advantage. Without some idea of the points mentioned, it is difficult to proceed to the discussion of the theoretical fundamentals of ancient Indian medicine, while the elaboration and substantiation of the points mentioned at the present stage would have meant weary digressions entailing the risk of losing the main thread of our discussion.

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[42] Sachau ii. 110 ff.

[43] See *Vinayapitaka,* Section on *Bhesajjaka.*

11. FROM MAGIC TO MEDICINE

The first point to be noted about the theoretical fundamentals of Ayurveda is that it takes the momentous step forward from magic to medicine.

The way in which the *Caraka-samhita* wants us to note this is that it moves from *daiva-vyapasraya bhesaja* to *yukti-vyapasraya bhesaja*—the former meaning magico-religious therapeutic and the latter rationalist therapeutic. The distinction is crucial for Ayurveda. It has moreover considerable importance for understanding the history of science in India, specially for that of the early formation of the theoretical fundamentals of natural science.

The two are contrasted in the very Sutra-sthana of the *Caraka-samhita*. It is taken up again in the Vimana-sthana (literally 'the book on specific proofs') discussing the methodology of medical science. Apparently the point receives much more than cursory importance in the ancient Indian compilation.

In the Sutra-sthana the distinction between the two therapeutic techniques occurs immediately after the description of the model physician. Proficiency in medicine understably requires the mastery of the theory and practice of the therapeutic (i.11.53).

What, then, is therapeutic ? The *Caraka-samhita* answers :

> Therapeutics are of three kinds, namely, (a) 'based on the supernatural' (*daiva-vyapasraya*=the magico-religious), (b) 'based on rational consideration' (*yukti-vyapasraya*=the rationalist one), and (c) 'based on self-control' (*sattvayajaya*).
>
> Among these 'therapeutics based on the supernatural' consist of incantations, amulets, gems, auspicious rites, offering oblations in sacrifices, taking vows, ritual penances, ritual fasting, propitiatory rites, worship, pilgrimage, etc.
>
> 'Therapeutics based on rational considerations' consist of prescribing natural substances as diet or drug.
>
> 'Therapeutics based on self-control' consist of withdrawing away the mind from unwholesome things. (i.11.54).

We read no more in the *Caraka-samhita* of the third form of therapy just mentioned, presumably because the avoidance of or withdrawal from the unwholesome is included in the extensive discussion of the drugs or diets in the compilation. We are thus left only with two forms of therapy—the 'supernatural' and the 'rational'.

Logically, therefore, the book on methodology (Vimana-sthana) mentions only the first two of these. The way in which the distinction between the two is re-explained has its own interest, though for its proper understanding we shall have to digress a little into some technical terms.

The knowledge of ten points is said here to be essential for medical practice. Of these the first five are *Karana* (*Kaarana*), *Karana*, *Karya-yoni*, *Karya* and *Karya-phala*.

Karana (*Kaarana*) or the cause means the agent or one who performs the act (iii.8.69); in the medical context, it means the physician (iii.8.84). *Karana* or instrument means that which is prescribed for the agent for performing his act (iii.8.70); in the medical context, it is the therapeutic technique itself (iii.8.84). By *Karya-yoni* or the source of action is meant that which, when attended to, leads to the effect designed; in the medical context, it means the loss of the balance of the body-elements (*dhatuvaisamya*) (iii.8.84), conceived in Ayurveda as the main cause of the disease or more simply the disease itself. *Karya* means that which the agent strives to bring into being (iii.8.72); in the medical context, it means the cure, i.e. the restoration of the balance of the body-elements (iii.8.84). *Karya-phala* means the ultimate benefit resulting from the effect; in the medical context, it means the well-being of the patient (iii.8.84).

For our present discussion what interests us most here is the concept of *Karana* or the therapeutic technique. Explaining it, the *Caraka-samhita* returns to what we have been discussing, namely the essential difference between magico-religious and rationalist therapeutics. Thus :

> It [therapeutic] is to be classed under two heads, depending upon that on which it is based. It is based either on the supernatural (*daiva*) or on reason (*yukti*).
>
> Of the two, that which is based on the supernatural consists of incantations, amulets, gems, auspicious rites, obligations and offerings in sacri-

> fices, vows, ritual penances, fastings, propitiatory rites, worship, pilgrimages, etc.
>
> The one based on reason consists of such measures the results of which are directly perceived (*drsta-phala*), i.e. measures leading to the restoration of the balance of body-elements. (iii.8.87)

Here, again, "magico-religious therapeutic" is clearly differentiated from the "rationalist" one. The former is described in words particularly identical with those used in the passage previously quoted from the Sutra-sthana. For the second, however, the expressions used are different. But such a difference is only apparent and can be easily explained : measures with *directly perceptible results as correction of imbalance of body-elements* are identical with measures in the form of the use of right diet or drug, or more specially, the use of natural substances specially of plant or animal origin as prescribed by doctors.

From the mention of two therapeutic principles in the text, however, it will only be an illusion to think that the medical compilations recommend both. The fact on the contrary is that, without bluntly rejecting the former—or giving some sort of lip-service to it for reasons to be discussed later—what the *Caraka-samhita* and *Susruta-samhita* stand for is essentially rationalist medicine. Other considerations apart—which, as we shall gradually see, are really numerous—a mere glance at the *Tables* labouriously prepared in two recent works published by the Indian National Science Academy[44] and intended to be the *Scientific Synopses* of the two grand medical compilations leave one with hardly any doubt about it. The therapeutic technique recommended in both is overwhelmingly rationalistic : the use of all sorts of substances as diet or drug intended to effect the perceptible result or the restoration of the balance of body-elements.

12. THE ATHARVAVEDA AND MAGIC

Historically speaking, here is a question of considerable importance. What is the *daiva-vyapasraya bhesaja* or magico-religious therapeutic that our compilations refer to ?

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[44] P. Ray and H. N. Gupta, *Caraka Samhita : A Scientific Synopsis* ; P. Ray, H. N. Gupta, M. Ray, *Susruta Samhita : A scientific Synopsis*.

There is only one answer to the question in the Indian context. It is that which comes down to us as embodied particularly in the *Atharvaveda* and its ancillary work called the *Kausika-sutra*.

Winternitz observes, "One of the chief constituent parts of the *Atharvaveda-samhita* consists of Songs and Spells for the Healing of Diseases which belong to the magic rites of healing (*bhaisajyani*) .....These songs of magic, together with the magic rites attached to them, of which we learn in the *Kausikasutra*... .form the oldest system of Indian medical science."[45]

The expression "Indian medical science" is evidently used here so broadly that in order to avoid abject contradiction, it needs be taken somewhat in a figurative sense. The reason for this is simple. Magic rites and songs belong to the stage of pre-science and not science, and this notwithstanding Frazer's thesis of magic being the precursor of science. Besides, it needs to be specially noted that the therapeutics of the *Atharvaveda*—the essence of which is described in the *Caraka-samhita* as *daiva-vyapasraya bhesaja*—are not simply magic but magic already mixed up with religion in a big way. Thus our medical compilations while taking their stand on "rationalist therapeutics" (*yukti-vyapasraya bhesaja*), need to be looked back as taking a momentous step forward from magico-religious understanding to an essentially rational and science-oriented position. Since the historical importance of this can hardly be overrated we may first have here a fuller idea of what rationalist medicine wants to outgrow, i.e. the medicine that comes down to us as codified in the *Atharvaveda* in particular.

The *Atharvaveda* enables us to see that in the ancient Vedic circle medicine begins basically in the same way in which it does among other peoples in their primitive stage, i.e. mainly as magical charms and incantations intended to appease, subdue or drive away all sorts of devils, demons and hobgoblins imagined to cause diseases. One of the two themes of the *Atharvaveda* is *bhesaja*, though not yet in the sense of later medical literature. As Dasgupta observes, "The word *bhesaja* in the *Atharvaveda* meant a charm or an amulet which could remove diseases and their symptoms."[46] To this he adds the following note : "Bloomfield says

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45. M. Winternitz. HIL i. 129.

46. S. N. Dasgupta HIP ii. 295 and *n*.

that the existence of such charms and practices is guaranteed moreover at least as early as the Indo-Iranian (Aryan) period by the stems *baesaza* and *baesazy*a.....and by the pre-eminent position of water and plants in all prayers for health and long life. Adalbert Kuhn has pointed out some interesting and striking resemblances between Teutonic and Vedic medical charms, especially in connection with cures for worms and fractures. These may perhaps be mere anthropological coincidences, due to the similar mental endowment of the two peoples. But it is no less likely that some of these folk-notions had crystallized in prehistoric times, and that these parallels reflect the continuation of a crude Indo-European folk-lore that had survived among the Teutons and Hindus."

A later work called the *Kausika-sutra* gives "the most minute directions for the performance of those magic rites for which the songs and spells of the *Atharvaveda* were used." S. N. Dasgupta's view concerning the possible development of ancient Indian therapeutic from the *Atharvaveda* to the *Kausika-sutra* may be noted here :

"In the *Atharvaveda* itself only a few medicines are mentioned, such as *jangida* (xix. 34 and 35), *gulgulu* (xix. 38), *kustha* (xix. 39) and *sata-vara* (xix. 36), and these are all tto be used as amulets for protection not only from certain diseases, but also from the witch-craft (*krtya*) of enemies. The effect of these herbs was of the same miraculous nature as that of mere charms and incantations. They did not operate in the manner in which the medicines prescribed in the ordinary medical literature acted, but in a supernatural way. In most of the hymns which appear as pure charms the *Kausika-sutra* directs the application of various medicines either internally or as amulets....the period of the Kausika-sutra was probably one when the value of the meicinal herbs was being more and more realized and they were being administered along with the usual *Atharvanic* charms. This was probably a stage of reconciliation between the drug system and the charm system."[47]

But there is no ground to think that even as supplemented by the *Kausika-sutra*, the system of *Atharvavedic* medicine shows much of any rationalist bent of understanding. Hhere is some idea of it given by Dasgupta : "*Atharvaveda* i. 2 is a charm against fever (*jvara*), diarrhoea (*atisara*), diabetes (*atimutra*), glandular sores (nadivrana); a string made of *munja* grass is to be tied, the mud from a field or ant-hill is to be drunk, clarified butter is to be applied and the holes of the anus and penis and the mouth of the sore are to be aerated with a leather bladder and the charm is to be chanted. The disease *asrava*, mentioned in this hymn, is explained by Sayana as meaning diabetes (*mutratisara*). *Atharvaveda* i. 3 is a charm against stoppage of urine and stool (*mutra-purisa-nirodha*). Along with a chanting of the hymn, the patient is to be made to drink either earth from a rat's hole (*musika-mrttika*), a *putika* plant, curd or saw-dust from old wood, or he is to ride an elephant or a horse, or to throw an arrow ; a fine iron needle was to be passed through the urinal canal. . . .. *Atharvaveda* i. 7 and i. 8 are charms for driving away evil spirits, *yatudhana*-s and *kimidin*-s, when a man is possessed by them. *Atharvaveda* i. 10 is a charm for dropsy (*jalodara*) : a jugful of water containing grass etc. is to be sprinkled over the body of the patient."[48]

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[47] *Ibid*. ii. 293 f.

More details of *Atharvavedic* medicine are not necessary. Even as supplemented by the *Kausika-sutra,* it gives us the impression of predominantly—if not exclusively—magico-religious therapy.

Thus admitting that the *Atharvaveda* represents for us the earliest discernible attempt to confront the phenomena of disease and cure and even admitting further that in the *Kausika-sutra* appended to it there is at best some desultory mention of the use of a few substances as curative agents, it is absurd to try to trace any kind of smooth development from it to the tradition basically represented by the *Caraka-samhita*. Not that the latter rejects the former in so many words. But in fact it turns away decisively from it. There is a qualitative step from the magico-religious medicine to the rationalist medicine. Between the two, in short, there is all the difference between pre-science and science.

13. THE UDDALAKA TRADITION

We can now see why the soil prepared for natural science by Uddalaka Aruni did bear fruit after all. Two of his outstanding achievements were the formulation of the scientific method and a unified view of man and nature—the latter based on his understanding of primeval matter from which evolves everything in the universe. Both, as we shall see, proved indispensible for the *hard core of natural science* or the *yukti-vyapasraya bhesaja* though, as we shall also see, in the medical circle both acquired immense richness.

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[48] *Ibid.* ii. 296.

We have emphasised above the expression "hard core of natural science" because it is in need of some clarification. Pending a fuller analysis of it in our *Appendix* we may very briefly note here a few points that require to be mentioned for the further progress of our discussion.

The medical compilations represent indeed spectacular schievements in natural science specially as judged in their historical contexts. But there are also formidable difficulties in settling these. On their own admission, the compilations pass through various hands before assuming the forms in which they reach us. Those through whose hands these passed did not maintain sufficient austerity to keep themselves restricted to the spirit of natural science. We shall see that there were objective conditions falling outside the restricted scope of natural science itself, that led them to undermine the scientific austerity. In any case, all sorts of heterogeneous and obviously incompatible ideas and attitudes are found embodied in both the compilations—perhaps more in the *Caraka-samhita* than in the *Susruta-samhita*—in their present forms. These, taken on their face value, make the works look like queer amalgams of science and anti-science.

S.N. Dasgupta who is about the only notable historian of philosophy to have realized the need of reviewing Ayurveda for a comprehensive understanding of ancient Indian thought, notes the point in his own way specially in his discussion of medical ethics. But he prefers to see in this some kind of peculiar "tolerance"[49] of the ancient physicians for views that could not be their own. Really speaking, however, the matter was much more serious than mere tolerance : it often amounted to flat and irreconcilable contradictions. Here is just an example. After elaborately discussing the question of the causes of fever and its cure, the *Caraka-samhita* is found to take a sudden flight into mythology and declares that fever is the result of the wrath of god Siva and goes on dilating on the story that, being humiliated in a certain sacrificial performance, Siva felt anger without bound ; this anger, as eventually percolating among human beings provokes fever among mankind (ii.1.35)! Evidently, this is a howling superstition imposed on science. Such superstitions abound in the *Caraka-samhita*.

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[49] *Ibid.* ii. 402 ff.

Mythological howlers apart, the compilations in their extant forms contain a good deal of metaphysical ideas and also practical precepts drawn from the stock of traditionally accepted orthodox views. We shall mention here only two as specimens of these.

We frequently read in these compilations that *moksa* or salvation of the soul from its material frame constitutes the highest human ideal. Not infrequently, again, we read of the doctrine of *Karma* widely prevalent among the philosophers, according to which whatever one enjoys or suffers at present life is determined by one's own actions performed in the past. A great deal of reflection is not evidently needed to see why such assumptions, taken seriously, make medical science really superfluous and even positively undesirable. Whatever may be the intrinsic worth of the concept of salvation of the soul from its material framework or the body, what medical science strives after all is the well-being and prolongation of this body itself. *Moksa* and medicine can thus hardly go together. Even admitting that there is something called Pure Spirit unfortunately imprisoned in the material body for the time being, the physician as physician can hardly do anything about it. His exclusive concern remains confied to the welfare of the body itself. Incidentally, one of the greatest representatives of the philosophy of Pure Spirit of the *Upanisad*-s, Yajnavalkya, gives us a description, enviable from his own viewpoint, of how the dying man gets progressively released from the bondage of the body along with its deceptive sense-organs.[50] Such a view, taken seriously, makes medicine not only irrelevant but even positively pernicious, inasmuch as the doctors are supposed to do their best to prevent the whole process. Similarly, the law of *karma*, taken seriously, can make the physicians as but passive spectators of the sufferings from disease and the happiness resulting from sound health, these being but professed results of actions performed by oneself in the previous birth. Incidentally, the Law of *karma* is considered so relentless that even the Lord God cannot interfere with it—a claim that makes the foremost representatives of the *karma*-theory, namely the philosophers representing Karma-mimasa or Purva-mimamsa argue in defence of stark atheism.[51]

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[50] *Br. Up.* iv. 4. 2-6.

Yet the fact is that the medical compilations, as these reach us, are often found to put a good deal of emphasis on the views of *moksa* and *karma*, not to speak of such sundry superstitions as worshipping the cow or the piety of making gifts to the Brahmins, and all these strangely coexisting with the striking scientific achievements.

There is thus scope to think that by showing utter indifference to *karma* and *moksa* Uddalaka had already prepared conditions for the emergence of rationalist medicine. But, in fact, he had to contribute more to the making of medicine as a science.

14. UNIFIED VIEW OF MAN AND NATURE : MATERIALIST HYPOTHESIS

The immediate consequence of the transition from magico-religious therapeutic to rationalist therapeutic is depopulating nature of all sorts of deities, which were, as once imagined, could be magically coerced or placated with prayers and propitiations to prevent or remove the diseases. Hymns and charms illustrating these abound in the *Rgveda* and *Atharvaveda*. But nature, once depopulated of imaginary deities, is left *as it is without any alien addition*, an understanding of which forms the essence of the materialist outlook. Man does not fall outside of nature. Hence an integrated view of man and nature forms the theoretical plank of rationalist medicine and it is the materialist outlook that serves the purpose of this integration. One reason that often prevents the modern scholars to see this has repeatedly been mentioned by us. Reckless of the question of self-consistency or internal coherence, all sorts of philosophical ideas and attitudes are grafted on the source-book of Ayurveda by their later editors and redactors, giving these the appearance of theoretical junkshops as it were. Nevertheless, it is possible for us to clean up such a mess and proceed to see their actual theoretical crux.

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[51] See Chattopadhyaya IA 202 ff.

The *Caraka-samhita* declares :

"Whatever concretely exists in the world, exists also in man (*purusa*); whatever concretely exists in man, exists also in nature. Such is the way in which intelligent persons want to view both" (iv.4.13).

But what exactly are the physicians driving at ? What, according to them, concretely exists both in man and nature, making the former an epitome of the latter ? The context in which the formulation occurs in the *Caraka-samhita* leaves us with no uncertainty about the answer. What the physicians are talking of is only matter and its transformation. The formulation, it needs to be noted, occurs immediately after discussing how natural matter in its five forms—viz. earth, air, water, fire and sky (*akasa*)—contributes to the formation of everything in the human body, beginning from its foetal stage. As the text, referring to the foetus formation, says : "In it (the foetus), even what is derived from the mother etc. is after all nothing but the transformation of matter" (iv.4.12).

Obviously enough, such a formulation is as important from the viewpoint of modern science as it is difficult for ancient science to work out. It needs a great deal of knowledge of matter and of the laws of its transformation to work out the proposition. The ancient scientists, who are just beginning to grope for the knowledge of matter, are not expected to give us any account of the body-formation from natural matter more satisfactorily than it is historically possible for them. Historically speaking, however, no less important is the point that some people somewhere must make a beginning of this understanding and thereby create the possibility for further research in the same direction. In ancient India at any rate the doctors (presumably following the suggestions of Uddalaka Aruni) appear to take this first bold step. The way in which they try to view everything in the body as made of natural matter is somewhat complex. Pending a fuller discussion of it, we quote here only the summary of the point as occurring in the present context of the *Caraka-samhita* :

> In it (i.e. in the foetus), sound, auditory sense, lightness, fineness and cavity are but transformations of matter in its *akasa*-form ; tangibility, cutaneous sense, roughness, holding together of the body-elements and movements located within the body are but transformations of matter in

its air-form ; colour, visual sense, brightness, digestion and heat are but transformations of matter in its fire-form ; taste, gustatory sense, coldness, softness, unctuousness and wetness are but transformations of matter in its water-form ; odour, olfactory sense, weight, stability and hardness are but transformations of matter in its earth-form. (*Ib*).

This, as we shall see, is in need of much explanation. But it represents the main point of the theoretical drive of the ancient Indian physicians. What they are trying to work out is thus not difficult to see. The fundamental unity of man and nature—that which makes man a microcosm of the world—is due to the fact that the human body is nothing but a special organization of matter.

Before proceeding further, we have to note the immediate implication of the physician's view of the unity of man and nature. Put in modern terminology, it means that physiology is inseparable from other branches of natural science like physics and chemistry, botany and zoology, mineralogy and climatology, and so on. If man and nature are basically the same, the knowledge of nature in every form must have its bearing on the full understanding of man. For the ancient physicians, however, these various disciplines are yet to branch out as forms of specialized natural sciences. They have therefore to grope for expressions to convey the idea of the grand principle of interconnection in nature, which makes the study of one of its facades unrelated to the whole as something necessarily incomplete. Yet the expressions they actually use are not without interest for us. Referring to matter in its five forms, the *Susruta-samhita* says :

> "(Five forms of matter) exist in everything in the world, because of their mutual interrelation, because of their mutual interdependence and because of their mutual interpenetration" (i. 42.3).

This gives us some idea of the grand view of interrelation and interpenetration of matter in all its forms on which ancient medicine depends. It follows for the physicians that though matter exists in five fundamental forms and though everything in nature is made of matter, there is hardly anything concretely existing in nature made exclusively or purely of one form of matter. Matter in all its five forms goes to the making of everything in nature.

What then do they mean when they speak of various things as "made of earth" (*parthiva*), "made of water" (*apya*), etc. The *Susruta-samhita* answers that though everything concretely existing in nature is made of matter in all its five forms, because of the predominance of one matter-form in something it is called "made of earth" or "made of water", etc. (i. 41.3).

We shall presently see the special need felt by the physicians to take such a view. What interests us here is the practical proposition following from it. In view of the basic principle of interpenetration and interaction of matter in everything belonging to nature, nothing in nature can be irrelevant for medicine. The medical compilations want to put special emphasis on this point. As the *Caraka-samhita* says :

> "The entire world is the teacher of the intelligent physician, as it is the foe of the fool" (iii. 8.14).

The other way in which the same is sought to be conveyed in both the compilations is to claim that everything in nature must have some bearing or other on medical requirements. Here is one of the expressions used in the *Caraka-samhita* for this fundamental assumption of Indian medicine :

> "There is nothing in nature without relevance for medicine" (i.27.330).

If such brief formulations are not adequate to convey the profound thesis that without the integrated idea of all aspects of nature, the knowledge of man remains incomplete, we must not overlook the important fact that the representatives of ancient Indian medicine work in their own way for the practical implementation of the idea. Historically speaking, they are the pioneers of a number of natural sciences in ancient India—of physics and chemistry, of botany and zoology, of mineralogy and climatology, etc. What is historically no less remarkable about them is that they do their best to integrate the knowledge of nature approached from different standpoints. For the sake of their science, the ancient doctors strive after the knowledge of nature as a whole.

That which makes it possible for them to strive after such knowledge is the fundamental theoretical conviction already mentioned. It is the conviction that the different facades of nature are interconnected, because everything in nature is made of the same stuff, namely *bhuta* or matter. This conviction is further strengthened by another—equally basic for Ayurveda—namely, that everything in nature occurs according to certain immutable laws, which is usually called *svabhava* in Indian thought.

Let us begin with one of the formulations just quoted and repeated again and again in our texts : "There is nothing in nature which is without relevance for medicine".

The repetitions are important. These show that the formulation is crucial for ancient Indian medicine. How then are the ancient physicians led to a tall generalization like this ?

The answer is obviously to be sought in the actual contexts in which these generalizations occur.

One of the contexts in which it occurs in our *Caraka-samhita* is the discussion of a somewhat staggering list of animate and inanimate substances and their products recommended for various medical purposes (i. 27.4-329). After giving the list, the text simply says that it is obviously impossible to discuss everything in the world from the viewpoint of their medical use. Since, however, there can be nothing in nature irrelevant for medicine, the things not covered by the present list are also to be judged by their qualities and according to the principles just discussed, also taking note of the local wisdom where such substances are found (i. 27.329-30).

The readiness to accept the wisdom of others indicates no doubt the open mind of these ancient scientists. But the formulation in the form in which it is just quoted may give us the impression of a hasty generalization based primarily on pragmatic considerations. We do not see in this context the rationale for the formulation. This does not mean, however, that the rationale is not there in our text. It is not mentioned in the present context for the simple reason that it is already explained in the immediately preceding chapter of the *Caraka-samhita* where the formulation first occurs.

What then is this explanation ?

The *Caraka-samhita* does not mince words about the materialist commitment of Ayurveda when it first introduces the formulation. It occurs in the report on a medical colloquium held in the Caitra-ratha forest, which is attended by about a dozen medical authorities. The subject discussed is the nature and number of taste-qualities of various substances, which, as we shall see, has great importance in medical theory. Summing up the discussion, Atreya, the spokesman of medical science, comes out with the following :

"In this discipline (i.e. medicine), everything is viewed as made of matter in five forms (*panca-bhuta*). These are either endowed with consciousness or are just unconscious. Their qualities are 'sound etc.' as well as 'heavy etc. ending with the liquid'. As already mentioned, their actions are fivefold, namely emesis, etc." (i.26.10)

The statement is categorical and it leaves us with nothing vague about the theoretical position of Ayurveda. Whatever else the metaphysicians may have to say, the physician in his special capacity cannot but be a materialist, because from the medical viewpoint there can be nothing which is not made of matter. Even substances endowed with consciousness are as much the products of matter as substances without consciousness.

It may be easy for us to call this materialism crude, naive and primitive. But that is not enough for the purpose of judging the theoretical position of the ancient physicians. The more important point is that the first decisive step taken by them towards positive science is characterized also by the awareness of the need for a materialist view of things. It is this that lays the foundation for patient researches of centuries to come, and hence is of abiding importance for science. Historically speaking, the detailed explanation of man and nature actually offered by the ancient physicians—the way in which they try to work out a comprehensive view of everything in terms of matter—cannot obviously be more satisfactory than their understanding of matter itself, as it was so in the case of Uddalaka Aruni. Still, neither the historian of science nor the historian of philosophy can possibly ignore it, because that will be as much of an error as any tendency to overrate its importance.

In this explanation, the point that interests the physicians most is that of the transformation of natural matter into body-matter. It is on the basis of this that they want to establish their therapeutic generalization that there is nothing in nature which is without relevance for medicine.

15. 'QUALITIES' AS INDICES TO MATTER

How then do they try to explain the making of man from the same matter that constitutes everything in nature? To follow their view, it is necessary first to see what they mean by the 'qualities', because it is by these qualities that they try to identify the substances, or more specifically, the kind of matter of which the different substances are made.

In the cryptic formulation just quoted, the qualities are mentioned under two heads, these are :

(a) 'Sound etc. (*sabdadayah*), and
(b) 'heavy etc. ending with the liquid' (*gurvadayah dravantah*).

The first of these two lists of qualities includes five.

These are :

1. sound (*sabda*), supposed to be the special quality of matter in its *akasa*-form,
2. touch (*sparsa*), supposed to be the special quality of matter in its air-form (*vayu*),
3. colour (*rupa*), supposed to be the special quality of matter in its fire-form (*tejas* or *agni*),
4. taste (*rasa*), supposed to be the special quality of matter in its water-form (*ap* or *jala*), and
5. smell (*gandha*), supposed to be the special quality of matter in its earth-form (*prthivi* or *ksiti*).

The other list of qualities, viz. 'heavy etc. ending with the liquid', as enumerated in the *Caraka-samhita* (i.25.36), includes twenty. Though it is sometimes difficult to have their exact English equivalents, we can roughly render these as follows :

1. Heavy (*guru*)
2. Light (*laghu*)
3. Cold (*sita*)
4. Hot (*usna*)
5. Unctuous (*snigdha*)
6. Dry (*ruksa*)
7. Slow (*manda*)
8. Acute (*tiksna*)
9. Stable (*sthira*)
10. Mobile (*sara*)
11. Soft (*mrdu*)
12. Hard (*kathina*)
13 Clear (*visada*)
14. Slimy (*picchila*)
15. Smooth (*slaksna*)
16. Rough (*khara*)
17. Subtle (*suksma*)
18. Gross (*sthula*)
19. Dense (*sandra*)
20. Liquid (*drava*)

Let us now see how with this two-fold list of qualities of substances, the ancient physicians proceed to explain both nature and man as made of matter in five forms and how from this explanation follows their cardinal formulation that there can be nothing in nature irrelevant for medicine.

In the *Caraka-samhita* Atreya continues his concluding observations on the medical colloquium just mentioned (i.26.10-2):

> Among the substances of the world, some are made (predominantly) of matter in its eath-form (*parthiva*). To identify them by their qualities, these
> (a) abound in the quality of smell, and are peculiarly—
> (b) heavy, rough, hard, slow, stable, clear, dense and gross.
> In the human body, these contribute to what is plump, compact, heavy and stable.
>
> Among the substances of the world, some are made (predominantly) of matter in its water-form (*apya*). To identify them by their qualities, these
> (a) abound in the quality of taste, and are peculiarly—
> (b) liquid, unctuous, cold, slow, soft and slimy.
> In the human body, these contribute to what is moist, unctuous, unifying, liquid, soft and pleasant.
>
> Among the substances of the world, some are made (predominantly) of matter in its water-form (*apya*). To identify them by their qualities, these
> (a) abound in the quality of colour, and are peculiarly—
> (b) hot, acute, subtle, light, dry and clear.
> In the human body, these contribute to what is burning, to the digestive process and to what has radiance, lustre and colour.
>
> Among the substances of the world, some are made (predominantly) of matter in its air-form (*vayaviya*). To identify them by their qualities, these
> (a) abound in the quality of touch, and are peculiarly—
> (b) light, cold, dry, rough, clear and subtle.
> In the human body, these contribute to what is dry, pain-giving, mobile, clear and light.
>
> Among tht substances of the world, some are made (predominantly) of matter in its *akasa*-form (*akasatmaka*). To identify them by their qualities, these
> (a) abound in the quality of sound, and are peculiarly—
> (b) soft, light, subtle and smooth.
> In the human body, these contribute to what is soft, porous and light.
>
> In the light of this knowledge, no substance is found in the world which is without relevance for medicine, i.e. which, as rightly used, does not serve some specific medical purpose.

This view of the transformation of natural matter into body-matter is absolutely crucial for Ayurveda. Hence it is found repeatedly emphasised in our medical compilations. If the view as just quoted appears to be too general to be of use for the physician's purposes, elsewhere in the *Caraka-samhita* we come across it in a more specific form. It occurs in the context of anatomical discussions. As the *Caraka-samhita* puts it :

> Matter (predominantly) in its earth-form (*parthiva*) goes to the making of everything in the body which is gross, firm, solid, heavy, rough and hard—as, for example, nails, bones, teeth, flesh, skin, faeces, hairs on the head and on face and other parts of the body, and the tendons. From this are also made odour and the olfactory sense.
>
> Matter (predominantly) in its water-form (*apya*) goes to the making of everything in the body which is liquid, mobile, slow, unctuous, soft and viscid—as, for example, 'organic sap' (*rasa*), blood, fat, mucus, bile, urine, sweat, etc. From this are also made taste and the gustatory sense.
>
> Matter (predominantly) in its fire-form (*agneya*) goes to the making of everything in the body that is of the nature of bile (*pitta*), heat and lustre. From this are also made colour and the visual sense.
>
> Matter (predominantly) in its air-form (*vayaviya*) goes to the making of everything in the body that is of the nature of inhalation and exhalation, opening and closing of the eyes, contraction and extension, movement, impelling, holding etc. From it are also made touch and the cutaneous sense.
>
> Matter (predominantly) in its *akasa*-form (*antariksa*) goes to the making of everything in the body that is of the nature of porosity and sound-producing, as well as the channels within the body, both gross and minute. From it are also made sound and the auditory sense. (iv.7.16)

One point in this view needs to be specially noted, because it has far-reaching consequences for Indian philosophy. It is concerning the origin of the sense-organs. Starting from the assumption that only the like is apprehended by the like, the physicians think that a sense-organ must be made basically of the same matter-form the specific quality of which it is capable of apprehending. Thus the specific quality of matter in earth-form is odour ; hence they think that not only everything in the body with the special quality of odour, but moreover the olfactory sense itself is made of matter in its earth-form. Similarly, from matter in its water-form originates the gustatory sense, because taste is supposed to be the special quality of water ; from matter in its fire-form originates the visual sense, because colour is supposed to be the special quality of fire ; and so on.

Besides all these, there is no doubt something ordinarily called the soul or the "mover" and which is supposed to be specially connected with the fact of consciousness (*buddhi* or understanding and *manas* or mind). How do the physicians account for it? The full commitment to materialism demands that this too is to be explained by matter, as it was actually attempted by the plain-speaking materialists of ancient India, called the Lokayatas or Carvakas. In the medical compilations however we do not come across a very clear and consistent tendency to explain consciousness by matter. But the possibilities of at least a section of the physicians subscribing to a materialist or near-materialist view of consciousness cannot be completely ruled out. We see elsewhere in the *Caraka-samhita* the distinct theory differentiating between "a substance endowed with consciousness" and "a substance without consciousness" by the simple criterion of the presence or absence of the sense-organs in it. As the text says, "A substance is called conscious when it is endowed with the sense-organs ; without the sense-organs a substance is unconscious" (i.1.48). Thus the mere presence of the sense-organs is supposed to endow a substance with consciousness. But the sense-organs are only the products of matter. In other words, in the formulation just quoted, there is nothing but matter and its transformations to endow a substance with consciousness.

But let us not impute to the physicians more of the materialist outlook than is obviously required for their main purpose, namely that of ensuring health or the cure of disease. As we have been discussing, from this viewpoint one of their basic propositions is : there can be nothing in nature irrelevant for medical purposes. The proposition occurs also in the *Susruta-samhita*, which, when properly analysed, leads us again to see the materialist commitment of the ancient doctors.

An entire chapter of the *Susruta-samhita* (i.40) is designed to establish the view that for medical purposes the substances (*dravya*-s) and their knowledge are most important. There was evidently much controversy among the ancient authorities on this point, for the text tries to establish this view after elaborately stating and refuting rival views attributing the same status to "taste-qualities" (*rasa*-s), "inherent potency" (*virya*) of substances by which these act on our bodies and the "process of transformation" (*vipaka*) of the substances consumed. Without undermining the importance of the knowledge of all these the text claims that the knowledge of substances is most important, because it forms the basis of all other knowledge required for therapeutic purposes.

In the next chapter (i. 41) the need is naturally felt for a more detailed explanation of what is meant by the substances. For this purpose, the *Susruta-samhita* proceeds straightway to give the theory of matter on which the medical understanding is based. All substances of nature, the text repeats, are made of matter in all its five forms, though because of the predominance of one of these matter-forms in a substance it is called "made of earth" or "made of water", etc. Next is discussed the qualities by which to determine whether a substance is made predominantly of earth or water etc., and what these matter-forms, consumed as various substances, contribute to the making of the body—a view, though not the same in every detail as the one we have just quoted from the *Caraka-samhita,* is substantially the same. What interests us most is that in the *Susruta-samhita***,** as in the *Caraka-samhita,* the view that there can be nothing irrelevant in nature for medical purposes follows directly and immediately from the discussion of all this. Since all substances in nature are made of the same matter that goes to the formation of the human body, there can be nothing irrelevant in nature for medical purposes. As the *Susruta-samhita* formulates :

> From what is just discussed (about the constitution of natural substances and the human body), we can easily understand that there is no substance in the world without relevance for medicine...
>
> The qualities discussed as belonging to the substances of the world, exist also in the human body. Therefore, the condition of the human body, its growth and decay, are all determined by the substances in nature (i.41.9-16).

The formulation is cryptic, but the point emphasized is not difficult to see. If the body is made of matter alone, any disturbed condition of it (which is called sickness or disease) can only be viewed as due to some disturbance in this material constituent, i.e. as due to the excess or diminution in it of matter in some form or other. The remedy accordingly can only be matter-readjustment in the body, i.e. more simply, either reduction or addition of matter in some form or other. Since everything else in nature is made of the same matter, everything in nature is supposed to have some relevance for this matter-readjustment in some way or other, i.e. for some medical purpose. It is inconceivable that something in nature should be made of the same matter by which the body is made, and yet it can be absolutely irrelevant for the general purpose of matter-readjustment as such, i.e. for the general medical purpose.

We shall later see how the ancient physicians try to conceive this problem of matter-readjustment as constituting the essence of their therapeutic technique. For the present the question is : Can the physicians, with such a view of man and nature, at all operate without a materialist outlook ? The *Susruta-samhita* comes out with a clear answer in the negative. Reviewing the philosophical views of ancient India—specially Vedanta and Vedanta-oriented Samkhya—it asserts that from the medical viewpoint only the materialist outlook has real relevance. Thus we are told :

> It is claimed that the knowledge of matter in its different forms is alone relevant for medicine, because in the therapeutic context it is impermissible to conceive of anything transcending matter : *bhutebhya hi param yasmat na asti cinta cikitsite* (iii.1.17).

Let therefore the metaphysicians have their own views and let not the physicians dabble with these. What is imperative for the physicians, however, is that they must not think of anything except in terms of matter.

If we are to trace the hard core of the medical tradition embodied in these compilations to some period earlier than the Buddha—which certain important evidences want us to do—we cannot possibly ignore the contribution of our physicians to the general fund of Indian philosophical ideas. In this ancient period, which is roughly the formative period of Indian philosophy, they perform the pioneering work of a bold world-outlook with a clear commitment to materialism. The point to be specially noted is that this materialism is not an avoidable hypothesis for them. It follows necessarily from the very commitment to their science. As physicians they cannot help being interested in the body, without the full knowledge of which their science is impossible. The *Caraka-samhita* wants to make no mistake about this :

"The physician has full knowledge of Ayurveda only when he understands the body in every way, in its entirety and in all its varied conditions. This Ayurveda ensures happiness for all." (iv. 6.19).

Secondly, they cannot escape the fact observed again and again that this body depends on the things consumed as food and drink. As *Caraka-samhita* adds :

"The body is verily the product of food" (i. 28.41).

Had the physicians left their understanding merely at this stage, their position would not have retained the theoretical interest that it has for us. It retains this interest because they wanted to take the further step of enquiring into the constitution of the things consumed and also into the nature of the transformation these undergo for becoming the body-constituents. This leads them to restate the simple fact of observation of food consumption in terms of the making of the body by natural matter. The *Caraka-samhita* says,

"Body means the totality of the transformation of five forms of matter—a totality that becomes the substratum of consciousness" (iv. 6.4).

Or, as the *Susruta-samhita* more pointedly says,

"The body is made of matter in five forms. Food also is made of matter in five forms. When fully transformed, the properties of the five forms of matter in food go to add to their counterparts in the body." (i. 46.533).

Not that we expect the ancient scientists to understand and explain the nature of this transformation in greater detail than is historically possible for them. But whatever may be the destiny of their understanding of the problem judged by the standard of detailed knowledge gained by research many centuries after them, the historical importance of the fact that they formulate the problem of the transformation of natural matter into body-matter cannot be denied. The very formulation of the medical problem in this way implies the rejection of the supernatural. This is specially significant in the ancient Indian context, where the priest-class is determined on twisting every bit of empirical knowledge then gained to suit their general demand for mystification and obscurntism and where moreover the officially boosted law of *karma* demands that everything about man is to be understood in terms of the "unseen" (*adrsta*) hangover of actions performed by him in his past life. In opposition to all these, it could not have been easy for the physicians to strive after a plainly materialist understanding of nature and man.

But how exactly do the physicians propose to explain the transformation of natural matter into body-matter ?

To begin with, they have to depend for this purpose on the knowledge of the technology available for them. It is basically the technique of the use of fire, which they observe is required for the profound transformation of material substances—as for example in the process of cooking the food or baking the earthen pot. Depending on this, they think that the transformation of the material things into body-constituents must be due to the agency of fire. Thus, the *Caraka-samhita* asserts :

"Just as the fire below transforms the rice-grains and water in the pot into cooked food, so the fire within the stomach transforms the food consumed into the organic sap (*rasa*) and excretory matter (*mala*)." (vi.15.8)

Thus is the obvious need of assuming some fire within the body, without which life is impossible. The *Caraka-samhita* wants to put special emphasis on the agency of the fire within :

> The life-span, complexion, vitality, good health, enthusiasm, nutrition, glow, corporeal vigour, lustre, heat and life-breaths are all 'due to the fire in the body' (*deha-agni-hetuka*).
>
> When this fire is extinguished, a man dies. So long as a man is endowed with it adequately, he lives long in good health. When it is deranged, he falls ill. Therefore everything is dependent on fire (*mulam agnih tasmat nirucyate*). (vi.15.3-4)

How to account then for the fire within the body ? The only theoretical equipment the physicians have to answer this question is their view of matter in five forms. Hence it is of considerable interest to see how they use it to account for 'fire within the body' and its crucial role in the transformation of environmental matter into body-matter.

As already seen, in the medical view everything in nature and man is made of matter in all its five forms, though in certain things matter in some form or other predominates. Thus, fire as a form of matter exists in all natural substances as well as in every body-constituent—may be in a predominant form or in some subsidiary form. It is this fire that effects the basic transformation of natural matter into body-constituents. The *Caraka-samhita* asserts :

> The five fires in the body, namely those existing in the body-constituents made predominantly of earth, water, fire, air and *akasa,* cook respectively their corresponding matter-forms—viz. earth etc.—in the food consumed which is composed of the same matter-form. (That is, fire in the body-constituent made predominantly of earth-matter cooks earth-matter of the food, etc.)
>
> Thus each matter-form of the substances consumed goes to increase its counterpart in the body. For example, (because of the action of fire) in the substances consumed, that, which is made predominantly of earth increases the body-constituent made predominantly of earth. Similarly, the remaining ones their counterparts in the body. Thus the body as a whole gets its nourishment. (iv.15.13)

Thus equipped with the theory of fire "cooking" within the body the food-substances consumed, the physicians attempt a full explanation of the formation of all body-constituents from natural substances—an explanation on which is based the fundamentals of their therapeutic principles. Here is a rather simplified version of it from the *Caraka-samhita* :

> (Thus cooked or transformed), food etc. are converted into two kinds of substances within the body. These are : (1) the desirable or nourishing ones (*prasada*), which is called *rasa* (or organic sap) and 2) the impure ones or waste products (*mala*), which is called excrement or *kitta*.
>
> From the excrement (*kitta*) are formed the following : sweat, urine, faeces, *vayu, pitta, kapha,* the dirty things excreted through the eyes, ear, nose, mouth, hair-follicles and genital organs (i.e. smegma etc.), as well as hairs on the head, the beard and hairs on other parts of the body, the nails, etc.
>
> From the foods transformed into the nourishing substance are formed all the desirable body-constituents like *rasa,* blood, flesh, fat, bone-marrow, semen, as well as the five substances constituting the sense-organs, the body-joints, ligaments, mucus, etc.
>
> All these body-constituents formed from the nourishing ones and the impure ones maintain (normally) their mutual proportion, according to the age and size of the body.

> Thus the nourishing substances and the excrements, retaining their proper proportion, maintain the belance of the body-elements in their substratum, the normal body (*evam rasa-malau sva-pramana-avasthitau asrayasya samadhatoh dhatu-samyam anuvartayatah*).
>
> Because of the increase or decrease of nutritional body-constituents (i.e. body-constituents produced from *rasa*) resulting from (faulty) eating, there is a loss of the balance of the body-elements ; health or cure of such a condition is the restoration of the balance of this group of body-constituents (effected by counter-diet). So also is the case of the excreta, resulting from what is called impurities. When some of the waste-products in the body exceed their normal proportion and require to be depleted, these are found to return to their normal condition (i.e. desirable proportion) and the body-balance is restored by being treated with counterdiets, with opposing qualities, like cold and hot.
>
> Of these body-constituents called nutritional substances and excreta, the means of passage is provided by channels within the body. These channels feed the various body-elements in the requisite measure and with proportionate constituents.
>
> In this manner, the body is the result of nourishment ingested in the four-fold manner—eaten, drunk, licked and masticated. The distinction between health and disease in body is due to the difference between having wholesome and unwholesome diet. (i.28.4-5)

This, as we shall later see, is far too simple an understanding of health and disease to allow the physicians to remain fully satisfied. They have to modify the view to suit their theoretical purposes. One fatal result of this is the degeneration of the medical theory into the stereotyped formulas of *vayu*, *pitta* and *kapha*. But more of this later. For the present it may be noted that already in the *Caraka-samhita* there is a good deal of discussion of these three, because the physicians evidently thought that of all the wate-products of food, these three—namely, *vayu*, *pitta* and *kapha*—have the most pronounced tendency to produce morbid conditions. But it will be an over-simplification of our text to take only these three as causing disease, which seems to be the view taken by Ayurvedic practioners of later times.

To resume the main discussion : the ancient doctors are led to attach very great importance to the question of the interaction between natural matter and body-matter, because they start from a simple but inescapable fact of observation. The fact is that various natural substances consumed by us as food and drink determine the conditions called health and disease. The *Caraka-samhita* wants to put special emphasis on this : "The only factor that promotes the growth of man (i.e. ensures his health) is the consumption of wholesome food. The consumption of unwholesome food again is the cause of diseases" (i.25.31).

The words *ekah eva*—"the only one"—are evidently intended to add emphasis to the formulation. If the text has elsewhere to amend it by way of adding other factors like climate conditions or environmental changes and even occupational hazards as also contributing to diseases, they never abandon the basic importance of food and drink. They even go to the extent of conceiving the phenomenon called "life" or *prana* as originating from food. Summing up a long discussion on food and drink, the *Caraka-samhita* says,

> "Life is just food transformed into life. All over the world, everybody strives after food. Complexion, physical grace, good voice, life, talent, happiness, contentment, growth, excellence of intelligence—all these are established on food" (i.27.249-50).

Thus, not to speak of the physical characteristics like complexion, strength, etc., even those faculties or qualities that are ordinarily viewed as psychical—talent (*pratibha*), excellence of intelligence (*medha*) etc.—are all derived from food. More remarkable than all this, is what is said about "life" or *prana*, about the mystery of which there is already a great deal of speculation in the country among the Upanisadic philosophers. The physicians appear to brush aside all these speculations when they say, "Life is nothing but food transformed into life" : *pranah pranabhutam annam*.

Lest there should remain anything vague about this view, the same chapter of our text opens with the statement :

> "The specialists assert that the phenomenon called life of those things that are known as living beings—i.e. of all creatures—is made of food and drink with desirable colour, smell, taste and touch, consumed in the right manner. They assert this, because of the results being directly observed": *ista-varna-gandha-rasa-sparsam vidhi-vihitam anna-panam praninam prani-samjnakanam pranam acaksate kusalah ; pratyaksa-phala-darsanat* (i.27.3).

16. METHODOLOGY : OBSERVATION AND EMPIRICAL DATA

In the passage just quoted the expression *pratyaksa-phala-darsanat* —"because of the results directly observed"—is in need of being specially noted. It gives us an idea of the main point of the methodology of the ancient physicians, the essential emphasis of which is on the primacy of direct perception. This cannot but remind us of Uddalaka Aruni, the first thinker in Indian history to have initiated the tendency of relying on the evidence of direct observation practically at every step of his discourse though he was yet to formulate the methological principle as sharply and elaborately as the physicians repeatedly did. Nevertheless it needs to be noted that by relying on direct observation in his theoretical quest, Uddalaka was going against the stream, inasmuch as in the officially boosted intellectual climate of Upanisadic India there was a marked tendency to undermine the importance of empirical evidence and to ennoble the free flight of pure reason. As Hiriyanna illustrates the point, "*Mundaka Upanisad* (i.1.4-5) classifies all knowledge into two—the higher (*para-vidya*) and the lower (*apara-vidya*), which are respectively the knowledge of *brahman* [=ultimate reality conceived as pure spirit] and of empirical things...... This view denies the name of *vidya* to empirical knowledge which, from the ultimate standpoint, is not knowledge at all, but only a sort of ignorance or *avidya*."[52]

The Upanisadic idealists take such a stance, because for them the *summum bonum* is *moksa* or the salvation of the pure spirit unfortunately imprisoned in the material body for the time being. But the doctors do not—and in fact cannot—care for such an attitude. What they are concerned with above all is the well-being of this body itself. So also they have no patience to denounce empirical knowledge which alone ensures it.

It is thus not difficult to understand why the entire Upanisadic literature should be silent about medical science. From the viewpoint of the lofty speculations of the dominant philosophers of the age, what the doctors are busy with is only a contemptible form of knowledge, ultimately guaranteed by direct observation. But how did the doctors themselves react to the dominant Upanisadic trend encouraging free flights of pure speculation? Presumably, they were annoyed by it. Thus the *Susruta-samhita* warns the physicians against empty speculations invading their field of directly perceptible results :

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[52] M. Hiriyanna OIP 69-70.

"A learned physician must never try to examine on grounds of pure reason the efficacy of a medicine which is known by direct observation as having by nature a specific medical result. Thus, for example, even a thousand logical grounds will never make the Ambastha group of drugs have a purgative function". (i.40. 12-13).

Here, therefore, we have an example of the protest against pure reason wanting to interfere with the results of direct observation. The herbs belonging to the Ambasthadigana are actually observed to cure cases of dysentry with excessive mucus in stool and hence the doctors have no patience for any speculation to prove the opposite.

But this emphasis on empirical evidence in Ayurveda must not be misunderstood. With all its enthusiasm for empirical data, the medical compilations are also earnest about processing such data by rational analysis and of extending knowledge beyond the rather limited scope of remaining confined to the evidences of bare sense-knowledge. It is this that leads the ancient doctors to develop an elaborate epistemology—an epistemology to which the *Nyaya-sutra* is presumably indebted. Nevertheless, the fact is that—as in the *Nyaya-sutra*—the accumulation of empirical evidence forms the foundation of this epistemology.

Before passing on to discuss the methodology in more detail we may as well have some further idea of how much the medical methodology depended on direct observation and what fruit it bore for the history of science in India. A convenient way of introducing all this is to begin with a rough idea of the curative agents mentioned in the medical compilations.

17. SAMPLE SURVEY OF CURATIVE AGENTS

Thakur Balwant Singh and K.C. Chunekar, who have devoted decades of patient research to identify the vegetable drugs mentioned in the three major works of Ayurveda, enumerate their number as follows :

"As regards the total number of drug plants mentioned in the three *samhita-s*, it appears, on a rough estimate, that it lies somewhere between six and seven hundred or it may be about six hundred, if the unidentified food grains, divine drugs and vegetable poisons are excluded, including of course the food-cumdrug plants and some of the drastic poisons accepted for use after some treatment. The number of Sanskrit names (excluding their derivatives) are about 1900, out of which, on a rough counting, about 670 are common to all the three texts and about 240, 370 and 240 have been exclusively mentioned in *Caraka-samhita*, *Susruta-samhita* and *Astanga-hrdaya-samhita* respectively."[53]

To this it needs to be added that the medical works do not discuss the plants as such. What these discuss instead are the effects on our bodies of the different parts and products of the plants. As the *Caraka-samhita* explains :

> "Root, bark, pith, exudation, stalk, juice, sprouts, alkalies, milk, fruit, flower, ash, oils, thorns, leaves, buds, bulbs and off-shoots are the plant products used in medicine." (i.1.73)

Besides, the same substance of plant origin is often observed to serve multiple medical purposes. One of the best examples of this is the fruit *amalaka* (*Emblica officinalis*), also called *amrta-phala* and *dhatri*. The *Caraka-samhita* alone mentions its use over a hundred times, prescribing it or preparations made of it mainly as a tonic.

But the medical compilations are concerned not merely with herbal pharmacy. The *Caraka-samhita*, for example, discusses over 200 varieties of animals of which 165 are major ones. Enumerating the different animal products used for medical purposes, it says, "Honey, milk, bile, fat, marrow, blood, flesh, excrement, urine, skin, semen, bones, sinews, horns, nails, hooves, hair, *gorocana*—these are the substances used in medicine from the animal world." (i.1.68-9)

As an example of the multiple use of the different products of the same animal, we quote here from the *Table of Medical substances of Animal Origin and Their Uses* prepared by P. Ray and H.N. Gupta in their *Caraka-samhita* : *A Scientific Synopsis* (pp. 40-41):

> *Go-carman* or cow-hide—its ashes recommended as an ingredient for a medicinal ghee, to be used internally in the treatment of insanity.

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[53] Balwant Singh and Chunekar Preface ix.

Go-ksira (*go-payas*) or cow's milk. Its uses—

1. external : in a medicated oil ; for burns, stiffness, etc.,
2. external : in an ointment ; for dislocation, fractures, etc.,
3. as an ingredient for a nutritive enema ; for anaemia, amenorrhoea,
4. internal : as diet ; for debility, spleen diseases,
5. internal : in a mixture ; for jaundice, consumption, etc.,
6. Internal : in a medicated ghee ; for menstrual disorders, tendency to abortion,
7. internal : in a linctus ; for heart diseases, excessive bile secretion, etc.,
8. internal : in candied sweets ; for heart-diseases etc.

Go-mamsa or cow's flesh. Its uses—

1. external : local application for absorption of venom ; for poisonous bites,
2. Internal : as soup or broth ; for irregular fever, consumption, emaciation, etc.

Go-mutra or cow's urine. Its uses—

1. external : as lotion ; for skin diseases,
2. external : in an ointment ; for pruritus, snake-bite, etc.
3. internal : as drink ; for jaundice, leucoderma, etc.,
4. internal : in a medicated ghee ; for insanity, epilepsy, etc.

Go-sakrt or cow-dung. Its uses—

1. external : burnt for fumigation as diaphoretic,
2. external : ingredient of a poultice ; for skin lesions,
3. internal : in a medicated ghee ; for piles,
4. internal : as ingredient for a medicated ghee, or as aqueous extract with honey etc.; for piles, poisoning, oedema, etc.,

Go-sarpis or cow's fat. Its use—

1. internal : in diet ; for debility, rheumatism.

Go-srnga or cow's horn. Its use—

1. inhalation of fumes when burnt ; for accumulation of phlegm.

Go-snayu or cow's sinews. Its use—

1. inhalation of the fumes when burnt ; for congestion of the respiratory tract.

In the same work Ray and Gupta prepare a *Table of Medical Substances of Mineral Origin and Their Uses*. It contains sixty-four main entries. We quote from this *Table* an example of the the multiple use of the same mineral substance or its products (p. 79):

Ayas or iron. Used for hot compress or fomentation ; for hard cutaneous swellings, varicocele etc.

Ayasa or finely powdered iron or specially prepared iron (also called *kalaloharajas*, *krsnayasa*, *kalayasarajas*).

Its uses—

1. external : in a dusting powder ; for cutaneous eruptions,
2. external : an ingredient of a poultice ; for inflammation,
3. external : in an ointment ; for blindness, unseparated eyelids, tumours, piles,
4. external : in a hair-lotion, as hair-tonic and hair-dye,
5. internal : in a prescription after prolonged contact with cow's urine ; for leucoderma, jaundice, anaemia, heart diseases, anal fistula, etc.,
6. internal : in a linctus ; for toxicosis, asthma, cough, hiccup, etc.,
7. internal : in an acid liquid mixture ; for obesity, flatulence, debility, etc.,
8. internal : in a pill ; for anaemia, jaundice, oedema, gastro-intestinal irritations, lithiasis, etc.

Ayomala or iron-rust (also called *Mandura*). Its uses—

1. internal : in a linctus ; for toxic condition with fever, spastic paraplegia, epilepsy, urinary disorders, skin diseases, etc.
2. internal : in a preparation after prolonged treatment with cow's urine ; for anaemia, dropsy, oedema, urinary disorders, jaundice, dysentery, intestinal parasites, etc.

Such Tables apart, the *Caraka-samhita* itself speaks of "six hundred purgatives and five hundred decoctions" (i.27.7), besides the eightyfour varieties of wines.

18. BOTANY IN ITS MAKING

The number of plants mentioned above is imposing indeed. A study of these along with that of the effects of their different parts on our body evidently initiates the science of botany, understandably with a medical bias. We may as well have a very brief idea of this botanical science.

As is only to be expected, the discussion of botany in our compilations begins with a classification of the vegetable world. In the Sutra-sthana of the *Caraka-samhita* (i.1·71ff) the vegetables are classified mainly under four heads which is also substantially accepted by the *Susruta-samhita* (i.1.22). These are : 1. Yielding fruits without blossoms (*vanaspati*), 2. Creepers (*virut*), 3. Yielding fruits after flowering (*vanaspatya*), and 4. Dying after the ripening of fruits (*osadhi*). Being medical texts after all, these are interested in the plant world mainly from the viewpoint of their efficacy as diet or drugs. Fortunately the laborious works done by Ray, Gupta and Roy—the two scientific synopses of the *Caraka-samhita* and the *Susruta-samhita*—already contain the essential points of this botanical knowledge, making it unnecessary for us to repeat it over again. This much, however, needs to be mentioned that *Table 3* on the medicinal plants and plant products and their uses in the scientific synopsis of the *Caraka-samhita* lists 341 plants mentioning their modern botanical names, mode of use and medicinal function (pp. 52-77). Similarly *Table III* of the scientific synopsis of the *Susruta-samhita* covering the same subject runs from p. 136 to p. 226. The reader may profitably go for these to have a broad idea of the amount of empirical data concerning the making of botanical science in ancient India.

19. ZOOLOGY IN ITS MAKING

The zoological science in its making, too, begins with a classification of the animal world. Apart from fifteen varieties of animals that fall outside the classified list[54] we read in the two medical compilations of animals classed under eleven heads which are as follows :

1. Creatures which grab and tear off their food like the horse, mule, etc. (*prasaha-varga*, containing 29 animals).
2. Burrowing animals like the frog, porcupine etc. (*bhumisaya-varga*, containing 13 varieties in all).
3. Creatures that dwell in marshy and wet lands like the buffallo etc. (*anupa-varga*, containing 9 varieties in all).

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[54] P. Ray and H. N. Gupta 37.

4. Creatures that live under water like the porpoise, crab etc. (*varisaya-varga*, containing 10 varieties in all).
5. Creatures that live around or on the surface of water like the swan, crane etc. (*ambucari-varga*, containing 29 varieties in all).
6. Herbivorous animals living in grasslands or forests like the deer, hare etc. (*jangala-varga*, containing 17 varieties in all).
7. Birds that scatter their food like the peacock etc. (*viskira-varga*, containing 19 varieties in all).
8. Birds that take and gobble their food like the woodpecker etc. (*pratuda-varga*, containing 30 varieties in all).
9. Parasites inhabiting the living body like lice etc. (*krmi-varga*, containing 20 varieties in all).
10. Creatures with poisonous fangs or stings like the scorpion etc. (*gomayu-varga*, containing 13 varieties in all).
11. Snakes (*sarpa-varga*, containing 9 varieties in all).

The grand total of the animals mentioned thus comes to nearly 230. For their more detailed description as well as relevance for medical science, the reader is referred again to the two scientific synopses we have mentioned.

20. GLIMPSES OF MINERALOGY AND SOIL SCIENCE

In *Table 4* of the scientific synopsis of the *Caraka-samhita* the compilers have prepared a list of 64 varieties of medicinal substances of mineral origin while in *Table IV* of that of the *Susruta-samhita* they catalogue 63 varieties of these. Research is still going on to determine how many of these are taken by our later editors and redactors of the texts from medical science abroad, but this much seems to be obvious that the representatives of rational medicine were about the earliest to take interest in the science of mineralogy. Incidentally it should be noted that a much more advanced discussion of mineralogy inclusive of the discussion of the technique of extracting the minerals from the ores and of mining for obtaining the ores is to be found in the *Arthasastra* (ii.12-15), though the *Arthasastra* has no interest at all in the medicinal use of the minerals, its exclusive concern having been the augmentation of the royal treasury.

We could have mentioned here many a passage from the texts showing the beginnings of soil science in ancient India. But we shall come to it in Section 23 while discussing *bhumi-pariksa* in the *Caraka-samhita*.

21. CLIMATOLOGY

Driven by their zeal for empirical data concerning man and nature, the ancient doctors lay in their own way the foundation of climatology. They feel convinced that climatic changes affect not only the constituents of the body but also the curative agents prescribed by them. The year is divided in the *Caraka-samhita* mainly under two parts, viz., *Uttarayana* or the period of the sun's northern course and *Daksinayana* or the sun's southern course. To the former belong the seasons Frost, Spring and Summer while to the latter belong the Rains, Autumn and Winter. The ancient doctors feel that during the Uttarayana—which, according to them, is the season of absorption (*adana*)—the wind becomes excessively dry, provoking within the body the three dry tastes, viz., bitter, astringent and pungent. By contrast, during the Daksinayana—which, according to them, is the season of libertion (*visarga*)—there is predominance of the liquid elements within the body, provoking the three non-dry tastes, viz., sour, salt and sweet. Accordingly they prescribe diet, drugs and also the behaviour pattern of the individuals avoiding their opposites. How far this discussion of seasonal variation was taken up by the late redactors of the texts from ancient Indian astronomy is of course a matter for further research, though this much seems to be clear that the representatives of rationalist medicine wanted to understand the influence of the climatic conditions on man and nature with a pronounced medical bias.

22. ANATOMY : DISSECTION

The zeal for direct observation finds its most spectacular expression in ancient Indian medicine when it insists that the dissection of the corpse is an absolutely essential need for acquiring the knowledge of anatomy.

The *Susruta-samhita* asserts that it is essential for the doctors—specially for the surgeons—to have sound knowledge of human anatomy. There are no doubt authoritative works on the subject from which the students of medicine and surgery can get this knowledge. But that is not enough. The knowledge gained from the text-book of anatomy can acquire certainty only when it is corroborated by the direct observation of the different organs within the body. How then can one have this knowledge based on direct observation? For the ancient Indian surgeons there is only one answer to it, and that is to dissect dead bodies.

How then is this dissection to be done? The *Susruta-samhita* answers :

> The different parts or members of the body as mentioned before—including even the skin—cannot be correctly described by one who is not versed in anatomy. Hence any one desirous of acquiring a thorough knowledge of anatomy should prepare a dead body and carefully observe, by dissecting it, and examine its different parts. For a thorough knowledge can only be acquired by comparing the accounts given in the *sastra*-s (authoritative works on the subject) with direct personal observation. (iii.5.59-60)
>
> A dead body selected for this purpose should not be wanting in any of its parts, should not be of a person who has lived up to a hundred years (i.e. up to a very old age) or of one who died of any protracted disease or of poison. The excrementa should be first removed from the entrails and the body should be left to decompose in the water of a solitary and still pool, and securely placed in a cage (so that it may not be eaten off by fish or drift away), after having covered it entirely with the outer sheaths of *munja* grass, *kusa* grass, hemp or with rope, etc. After seven days the body would be thoroughly decomposed, when the observer should slowly scrape off the decomposed skin etc. with a whisk made of grass-roots, hair, *kusa* blade or with a strip of split bamboo and carefully observe with his own eyes all the various different organs, internal and external, beginning with the skin as described before (iii.5.61).

It must have been extremely difficult to procure for the purpose of dissection a dead body, particularly one with the specifications mentioned by the surgeons. In other words, such a corpse must have been something extremely precious for anatomical studies and hence could not be allowed to be mutilated by the beginners yet to acquire the skill of dissection. It seems that such a consideration leads the ancient surgeons to recommend some kind of a preparatory course for acquiring the technical skill of dissection by practising it on certain fruits and dummies. In any case, we read in the *Susruta-samhita* an account which may as well be taken as getting the students of bio-sciences in ancient India prepared with the technical skill of using the knife. The text says :

> The preceptor should see his disciple attend the practice of surgery even if he has already thoroughly mastered the several branches of the science of medicine, or has pursued it in its entirety. In all acts connected with surgical operations of incision, etc., and injection of oil, etc., the pupil should be fully instructed as regards the channels along or into which the operations or applications are to be made. A pupil, otherwise well-read, but uninitiated in the practice (of medicine or surgery) is not competent to take in hand the medical or surgical treatment of a disease. The art of making specific forms of incision should be taught by making cuts in the body of a *puspaphala* (a kind of gourd), *alavu* (bottle-gourd) or *ervaruka* (cucumber). The art of making cuts either in the upward or downward direction should be similarly taught. The art of making excisions should be practically demonstrated by making openings in the body of a full waterbag, or in the bladder of a dead animal, or in the side of a leather pouch full of slime or water. The art of scraping should be instructed on a piece of skin on which the hair has been allowed to remain. The art of venesection should be taught on the vein of a dead animal, or with the help of a lotus stem. The art of probing and stuffing should be taught on worm-eaten wood, or on the reed of a bamboo or on the mouth of a dried *alavu* (gourd). The art of extracting should be taught by withdrawing seeds from the kernel of a *vimbi* or *vilva* or jack-fruit, as well as by extracting teeth from the jaws of a dead animal. The act of secreting or evacuating should be taught on the surface of a *salmali* plank covered over with a coat of bee's wax, and suturing on pieces of cloth, skin or hide. Similarly, the art of bandaging or ligaturing should be practically learnt by tying bandages round the specific limbs and members of a full-sized doll made of stuffed linen. The art of tying up a *karnasandhi* (severed ear-lobe) should be practically demonstrated on a soft severed muscle or on flesh, or with the stem of a lotus lily. The art of cauterising, or applying alkaline preparations (caustics) should be demonstrated on a piece of soft flesh ; and lastly the art of inserting syringes and injecting enemas into the region of the bladder or into an ulcerated channel, should be taught by asking the pupil to insert a tube into a lateral fissure of a pitcher, full of water, or into the mouth of a gourd (*alavu*).
>
> An intelligent physician who has tried his prentice hand in surgery (on such articles of experiment as gourds, etc., or has learnt the art with the help of things as stated above), or has been instructed in the art of cauterisation or blistering (application of alkali) by experimenting on things which are most akin, or similar to the parts or members of the human body they are usually applied to, will never lose his presence of mind in professional practice. (i.9.2-3.B)

Beginning thus with such substitutes and dummies, the student must acquire sufficient surgical skill before applying it on the human corpses. But the point is that the practice on such substitutes is not enough for the study of surgery and medicine. Notwithstanding the importance of preparatory practices like these, the *Susruta-samhita* does not want the medical students to stop at it. It insists that the actual dissection of the corpse is a must, because this is the only way of directly observing the different organs within the body and direct observation alone ensures the ultimate certainty of our knowledge.

This emphasis on the supreme importance of knowledge based on direct observation is enough to annoy the spokesmen of orthodoxy, because it leaves hardly any scope for their advocacy for the implicit faith in the scriptures. However, the *Susruta-samhita* has reasons to annoy them much more when—carried by its zeal for empirical data—it goes to the extent of claiming that the actual dissection of the corpse is an essential precondition for anatomical knowledge. In the orthodox view, the corpse is something too impure to be normally touched. If one is compelled to touch it, say for the purpose of carrying it for cremation, one has to perform purificatory rites to get rid of the impurity or pollution resulting from the touch. This is a point persistently emphasized by the Indian law-givers, beginning with Apastamba and Gautama, who lived some centuries before the Christian era. We shall mention here only a few example.

Apastamba says that the presence of a corpse—like that of the meanest human beings called Candalas—is so polluting for the entire atomosphere that even the study of the holy scriptures has to be suspended there. As he puts it, "(One must not study the scriptures in a village) in which there is a corpse or in such a one where the Candalas live. One must not study where corpses are being carried to the boundary of a village." (i.3.14-6)

Gautama says, "On touching (i.e. on carrying) a corpse from an interested motive (i.e. with the intention of gaining a fee or the like), the impurity lasts for ten days." (xiv.23) The commentator Haradatta explains, "The word impurity indicates here merely that the performer of the act must not be touched and has no right to perform sacred ceremonies." Gautama continues, "On touching an outcast, a Candala, a woman impure on account of her confinement, a woman in her courses, a corpe, and on touching persons who have touched them, he must purify himself by bathing dressed in his clothes. Likewise, if he has followed a corpse that was being carried, and if he has come into contact with a dog." (xiv.30-2) Manu declares, "Those who have touched a corpose are purified after one day and night, added to three periods of three days...... A pupil who performs *pitrmedha* for his diseased teacher, becomes also pure after ten days, just like those who carry the corpse to the cremation ground." (v.64-5) Again, "When he has touched a Candala, a menstruating woman, an outcast, a woman in childbed, a corpse, or one who has touched a corpse, he becomes pure by bathing." (v.85) And so on. A large number of passages like these can easily be quoted from the Indian legal literature, beginning from its earliest phase.

It is not necessary for our present purpose to trace the origin of the belief according to which the very act of touching a cropse is a pollution. The belief may have its origin in the primitive ignorance concerning the possible magical contamination by death. But the more important point is to note that the belief, as we come across it in the Indian legal literature, acquires the form in which the primitive ignorance is already institutionalized by the powerful priest-class. Outside the ideological underworld usually called Tantrism, any act of deliberately touching the corpse is a gross transgression of the code of conduct as outlined by the law-givers. This creates formidable difficulties for the progress of medical science in the country.

We need not necessarily go back to the ancient period to see the nature of the difficulty. Here is a passage from *A Biographical Sketch of David Hare* by Peary Chand Mittra, which enables us to see vividly how the difficulty continued even in the thirties of the nineteenth century, when the Calcutta Medical College was founded :

"I will state however one fact which will show how Mr. Hare was anxious to see the project of the Medical College finally brought about and settled without opposition. One evening as I was sitting with him, I saw Baboo Muddosuden Gupta, the then Professor of Sanskrit Medical Science of the Sanskrit College, entering the room in all haste. Mr. Hare viewing him said at once—'Well, Muddo what have you been doing all this time? Do you know what amount of pain and anxious thoughts you have kept me in for a week almost? I have met Radhacant, and I am hopeful from what he said to me. Now what have you to say? Have you found the text in your Shester authorising the dissection of dead bodies?' Muddoo answering in the affirmative said, 'Sir, fear no opposition from the orthodox section of the community. I and my pundit friends are prepared to meet them if they come forward, which I am sure they will not do.' Mr. Hare felt himself relieved at this declaration on the part of the professor, and said he would see His Lordship tomorrow positively, meaning as far as I can recollect Lord Auckland."[55]

What trump card Madhusudan Gupta was then holding against the orthodox community is not known to us. This much is known, however, that when—in 1836—scalpel in hand he followed Dr. Goodeve to the godown for the actual dissection of a corpse kept there, his courage had to be boosted by the booming guns from Fort William.

If, hardly about hundred and fifty years back, so much of courage is needed to overcome the orthodox opposition to dissection—and all this even under the protection and patronage of a powerful Government—it is not difficult to imagine how much greater courage must have been required of the ancient scientists to prescribe a detailed mode of dissection as an essential precondition for attaining medical proficiency. But this courage of the pioneers of medical science must have made them the objects of intense contempt in the eyes of the spokesmen of Indian orthodoxy—the law-givers. If the bold defence of the need for dissection is a unique feature of the Indian medical literature, the hatred for the doctors and surgeons is also a unique feature of the Indian legal literature. But more of this in our *Appendix*.

23. DIAGNOSIS : EXTENSION OF SENSE-KNOWLEDGE

The main drive of ancient Indian medicine is thus towards direct observation which results in the accumulation of the vast amount of empirical data. Such data, it is true, are compiled mainly by unaided sense-organs. But the significance of this again is not to be undermined. In spite of being inevitably dependent on unaided sense-organs, the physicians also fell the need for extending their knowledge beyond the limits of bare sense-perceptions. We quote here a long passage from the *Caraka-samhita* which, though occurring in the context of diagnostic purposes, also shows the general need felt in Ayurveda to extend the range of such knowledge.

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[55] . Peary Chand Mittra, *A Biographical Sketch of David Hare*, Calcutta 1949 ed. [first published 1877] pp. 138-9.

Three indeed are the modes of ascertaining the specific nature of a disease. These are (a) authoritative instruction (*apta upadesa*), (b) perception (*pratyaksa*) and (c) inference (*anumana*). Of these, authoritative instruction means knowledge imparted by authoritative persons. Authoritative persons, again, are those who possess undisputed knowledge and memory, the technique of classification and whose observations are not affected by subjective factors—likes and dislikes. Because of being thus characterised, what they say is authoritative. By contrast, the words coming from persons that are inebriated, insane, stupid, subjectively inclined and given to half-truths are unauthoritative.

Perception is that which is directly known by one's sense-organs and mind (which, even in later Indian thought, is generally viewed as an internal sense directly perceiving subjective states like pleasure and pain).

Inference is cogitation based on rational application (*tarkah yukti-apeksah*). [But more of the meaning of inference later.] The diagnosis of a disease is faultless only after the disease has been fully examined in all its aspects with the help of these three ways of knowing. The full knowledge of an object cannot be obtained by only one of these ways of knowing.

Of these three ways of knowing, the starting point is the knowledge derived from authoritative instruction. At the next step, it has to be critically examined by perception and inference. Without there being some knowledge obtained from authoritative instruction, what is there for one to examine critically by perception and inference? For the learned, therefore, there are two modes of critical examination, viz. perception and inference. Or, if authoritative instruction also is included, the modes of critical examination are three.

The learned (authorities) instruct as follows. Each disease is to be viewed as having such and such exciting factors, such and such sources, such and such onsets, is of such and such nature, has such and such location, produces such and such feelings (in the patient), has such and such symptoms, is characterised by such and such complications, has such and such stages of aggravation, stabilization and abatement, has such and such after-effects, has such and such names and is due to the contact with such and such things. From authoritative instructions are also known the remedies of a diseases—both curative and preventive.

One wanting to know the nature of a disease by perception should examine everything perceptible in the body of the patient and should use for the purpose all the sense-organs excepting the gustatory one. Thus for instance one should examine with the auditory sense the intestinal sounds, the sounds of the joints and finger knuckles, variations in the patient's voice, or any other sound that may be present in any part of the body.

With the visual are to be examined the colour, shape, proportion and the general appearance as well as changes in physique and behaviour of the patient. Besides, whatever else can be the object of visual knowledge should also be similarly examined.

The examination of the patient's body by the sense of taste, though falling under direct observation (perception), is prohibited. One should take recourse to inference for the purpose. Thus, the physician should ascertain the existing taste in the patient's mouth by the method of interrogation. The insipidity of the body-secretions of the patient is to be determined by the lice etc. deserting his body and the excessive sweetness of his body-products from the flies etc. accumulating on the body. If the disorder of hemothermia is suspected and it is necessary to determine whether the patient's blood is healthy or vitiated by bile, the physician should conclude that the blood is healthy if a sample of it is eaten by a dog, crow, etc. ; if it is not eaten, the physician should infer that it is a case of hemothermia. In similar ways, the physician should know by inference the state of the rest of the patient's body-fluids.

By the olfactory sense, the physicians should know the smell in the entire body of the patient, i.e. whether it is normal or abnormal.

The physician should examine the feel of the patient's body by his hands (i.e. the sense of touch).

Such then are the ways of examining the patient by perception, inference and instruction (authority).

The following data should also be obtained by inference. Thus, the condition of digestive fire is to be determined by the patient's power of digestion, the patient's strength by his capacity for physical work, the condition of his sense-organs like ear etc. by their capacity for perception, the condition of his mind from his power of concentration, his understanding from the purposive nature of his actions, his passion from the intensity of his attachment, his infatuation from the lack of his understanding, his anger from the violent nature of his actions, his grief from his despondency, his joy from his exhilaration, his pleasure from his expression of satisfaction, his fear from his dejection, his fortitude from his courage, his vitality from his enthusiasm, his resolution from the absence of his vacillation, his faith from his opinions, his intelligence from his power of comprehension, his state of consciousness from the correct response to his name, his memory from his power of recollection, his modesty from his bashfulness, his character from his conduct, his aversion from his refusals, his evil intentions from his performances. The age, predilection, homology and etiological factor of the patient are to be inferred from the stage of his life, residence, homologous signs and the nature of pain respectively. Diseases with latent symptoms are to be inferred from the results of tests with curative or provocative medications, the degree of morbidity from the provocative factors, the imminence of death from the severity of the fatal prognostic signs, the expectation of recovery from wholesome inclinations, the clarity of mind from the absence of incoherence. As regards hard-bowelled condition or soft-bowelled condition,

> the nature of his dreams, his cravings, his likes and dislikes, his pleasures and pains—all these are to be known by interrogating the patient. (iii.4.3-8)

Evidently, however, even such a thorough examination of the patient and his symptoms does not fully satisfy the ancient doctors. They want to know more about the patient—specially his environmental and other peculiarities, which, they feel, are also related to his condition. Hence the *Caraka-samhita* mentions also the need for *bhumi-pariksa* or "the examination of the place" for a more adequate understanding of the patient. Under this is recommended the collection of the following data :

> The doctor has to know the country where the patient is born, grows up or has developed the disease. The peculiarity of the country (whether it is arid or marshy etc.) has to be noted and along with it are to be noted the nature of the food-habits of that place, the mode of living and other customs of the people there. The doctor has to note the nature of the physical strength and mental make-up of the people, their general condition of health and the peculiarity of their habitat, their special proclivities, the kind of diseases by which they are usually infested and also what is usually considered as wholesome or unwholesome in these regions. Such then are the points which the physicians must note. (iii.8.93)

In the *Susruta-samhita* also strong emphasis is put on the importance of direct sense-perception for diagnostic purposes :

> (Having entered the sick-room) the physician should view the body of his patient, touch it with his own hands, and enquire (about his complaint). Several authorities hold that these three (inspection, touch and questioning) largely form the means of our ascertaining the nature of a disease. But that is not correct, inasmuch as the five sense-organs of hearing, sight, etc. and oral enquiry materially contribute to better diagnosis.
>
> Diseases which are to be diagnosed with the help of the organ of hearing will be fully treated later on... The heat and coldness of the body, or the gloss, roughness, hardness or softness of the skin of the affected part, as in fever, or in an oedematous condition of the body, are perceptible by the sense of touch. Fullness or emaciation of the body (*cachexia*), the state and indications of vitality, strength, complexion etc. are perceived by the sense of sight. Secretions of discharges (from the inflamed mucous members of the urethra) in *prameha* etc. should be tested with the organ of taste. The characteristic smell emitted by an ulcer in its critical stage should be determined with the help of the organ of smell.

> While such facts as the time or season of the disease, the caste which the patient belongs to, the things or measures which tend to bring about a manifest amelioration of the disease, or prove comfortable to the patient, as well as the cause of the disease, the aggravation of pain, the strength of the patient, and his state of digestion and appetite, the emission of stool, urine and flatus, or their stoppage, and the maturity of the disease as regards time, should be specifically ascertained by directly interrogating the patient (on these subjects). Though the above-said five organs of sense help us to make the correct diagnosis of a disease, still the objects locally perceived by these senses should not be left out of account in ascertaining its specific nature. (i.10.3-5)

24. PERPETUAL FLUX

The starting point of the ancient doctors, as we have already seen, is the simple observation of how the human body is being affected in various ways by all sorts of natural substances or nature as a whole. This is interpreted by the physicians as the interaction between natural matter and body-matter. We now pass on to see what follows from this understanding.

Since the absorption of natural or environmental matter by body-matter is a ceaseless process for the living beings—since, in other words, the fact of nutrition shows the perpetual replacement of the material constituents of the body—the body itself and everything about it is viewed in Ayurveda as being involved in the process of ceaseless flux. For the ancient physicians this means that the old body is being constantly replaced by a new one and the apparent impression of the persistence of the same body is due only to the similarity between the old body and the new body. As the *Caraka-samhita* says,

> Nothing about the body remains the same. Everything in it is in a state of ceaseless change. Although in fact the body is produced anew every moment, the similarity between the old body and the new body gives the apparent impression of the persistence of the same body. (iv.1.46)

But man is viewed as a microcosm—an epitome of nature. If, on the one hand, it means that without the knowledge of nature the knowledge of man remains incomplete, the same formulation on the other hand implies that what is true of man is also true of nature as a whole. Thus the view of man as ceaselessly changing leads the physicians to develop the same or a similar view of nature. Everything in nature is involved in the eternal process of coming into being and of passing out of existence. In expressing this view, the ancient physicians want specially to deny any external agency accounting for the cessation of things that come into being and they propose to explain everything on the model of "time" (*kala*), the essence of which is ceaseless change. Says the *Caraka-samhita*,

> Just as there is no external cause for the destruction of time, which, by nature, is perpetual flux, so also no (external) cause is known for the destruction of things, because of the simple reason that no such cause exists. Being evanescent by nature, things cease to be just as they come into being. (i.16.32-3)

Understandably, the phenomenon called life—in which the physicians are so keenly interested—cannot be an exception to this universal process of coming into being and passing out of existence. Hence it is only natural that the physicians should want us to note the essential transitoriness of life. In their view, life is nothing but the right combination of certain material substances, which they call the desirable kind of food materials. The ceaseless process of further absorption of food materials by the living beings makes them perpetually changing. Because of the laws inherent in nature, however, this process of ceaseless change in the matter-constituents of the body reaches a stage where the body-form itself disintegrates and its matter-constituents start reverting to their original or natural state. Life, which comes into being, thus ceases to be. This is ordinarily called death or *marana*. Since, however, in the physicians' view this is nothing but the return of body-matter to matter in its environmental or natural condition, one of the synonyms they propose for *marana* is *svabhava*,. Significantly, another synonym proposed for the same is *anityata* or impermanence. Referring to the symptoms of the approaching end of a man's life, the *Caraka-samhita* says,

> From these it can be predicted that he would revert to nature during such and such moment and such and such hour.
>
> . . . Here (in Ayurveda) 'nature' (*svabhava*), 'end of activities' (*pravrtteh uparamah*), 'death' (*marana*), 'impermanence' (*anityata*) and 'cessation' (*nirodha*) are all synonymous terms. (i.30.27)

All this gives us an idea of another notable feature of the general theoretical position which the ancient physicians try to work out. This, along with their conviction that from the medical viewpoint, at any rate, only the materialist outlook has relevance, gives us the glimpse of a world-view, magnificent in its ancient context. In this world-view, everything in the universe is made of matter (*bhuta*) and everything is in a state of perpetual flux (*nityaga*). Under certain favourable but essentially natural conditions, organized matter assumes the form of what is called "life" or *prana* of the living creatures. These living creatures, constantly absorbing environmental matter for their mode of existence, which is medically called nutrition, are themselves involved in the process of ceaseless change. But life, which under certain conditions comes into being, also passes out of existence because of the laws inherent in nature, when matter constituting the organism reverts to its natural state, i.e. to the state of environmental matter from which life originates and which sustains life, subjecting it to the process of constant change. And this is death, alternatively called 'nature' or 'impermanence'.

25. THEORY AND THERAPEUTIC TECHNIQUE

According to the basic theoretical generalization of Ayurveda, thus, everything is made of matter and everything is involved in the ceaseless process of coming into being and passing out of existence. From the medical viewpoint, all this raises a crucial question. Where and how, in this general scheme of things, do the doctors come in ? They are not philosophers. Their purpose is to help maintain health and cure diseases.

If therefore the physicians feel the need for some general theoretical understanding as well, it is presumably considered essential for their basic therapeutic purpose.

What then is the relevance of their theory for medical practice ?

From the physician's viewpoint, the answer to this is not difficult to see. To ensure health or cure sickness, it is first of all necessary to understand what these mean. Serious preoccupation with the problem leads them to the view of the interaction between environmental matter and body-matter, because, according to their understanding, everything about the body—inclusive of health and disease—depends on it. Environmental matter existing in the forms of different natural substances goes to the making of the body-constituents, called *dhatu*-s. But there is a right way as well as a wrong way in which this transformation can take place. Environmental matter consumed in the right form, in right proportion and right combination, results in what is supposed to be the proper balance or harmony or equilibrium of the body-elements. Health means nothing but this balance. Disease again is the loss of this balance resulting from the wrong way of absorbing environmental matter, i.e. either the over-absorption or under-absorption of a specific form of it.

From this understanding of the body and the causes of its diseases, immediately follows the main point of the therapeutic technique. To put in very general terms, it is matter-readjustment within the body aiming at the restoration of the balance of the body-elements. The *Caraka-samhita* wants repeatedly to emphasize this point. Thus :

> Here (in medical science), the effect aimed at is the balance of the body-elements. The purpose of the present work is to instruct on the effective measures ensuring the balance of the body-elements. (i.1.53)

Again :

> By treatment of diseases is meant those operations that lead to the balance of the body-elements. This is to be understood as the function of the physician. What the physician does is done with the purpose of not allowing the loss of balance of the body-elements or of ensuring the continuation of this balance. (i.16.34-5)

But how is the physician expected to ensure the balance of the body-elements ? From the viewpoint of Ayurveda, there is only one answer to this. Since the body-elements are nothing but transformations of various natural substances, the only way of ensuring their balance is the regulation of the natural substances to be consumed. As our text puts this, "By avoiding things that cause the loss of the balance and by consuming things that favour it, the discordance of the body-elements is not allowed to persist and their concordance brought into being". (i.10.6)

But everything in nature as well as in man is made of matter in its five forms. Hence the therapeutic principle, put in more general terms, means that if there is an excess of body-matter in some particular form resulting from the wrong absorption of environmental matter, the physician has to prescribe as diet or drug the kind of substances that have the efficacy of bringing down this particular form of body-matter to its normal level, i.e. to the level at which it retains balance with body-matter in other forms. Secondly, if there is diminution of body-matter in some specific form resulting from the lack of absorption or inadequate absorption of environmental matter in this form, the physician has to prescribe as drug or diet certain specific substances which, when transformed within the body, raises the affected body-matter to its required level. Thus, another way of viewing the essential point of the therapeutic technique is to call it the "use of the opposite", i.e. the use of substances having "opposite" effects on the body-matter aggravated or diminished. We quote here two examples of how this is formulated in the *Caraka-samhita* :

> By treating disorders of the body with what are opposite to their origin, we restore the normal condition of the patient. Thus administered by us, the drugs show themselves to the best of their glory. (i.10.6)

Again :

> Diseases that are curable are cured by drugs (substances) with antagonistic qualities, administered with consideration of place (*desa*, i.e. the environmental condition of the patient), dose (*matra*) and time (*kala* i.e. seasonal variation or variation of climatic conditions). (i.6.62)

26. SAMANYA AND VISESA

This expression for the therapeutic technique, namely "the use of the opposite", is in need of some explanation. It means no doubt that the physician's task is to increase what has become diminished and to diminish what has become excessive among the body-elements. Concretely speaking, however, the only way open before him to try both the procedures is to prescribe certain substances as diet or drug. From the standpoint of their effects on the body-elements, therefore, the substances prescribed may also be viewed as having twofold effects. Certain substances have the inherent nature of increasing some particular body-element, just as certain other substances have the inherent nature of decreasing some particular body-element. In relation to their effects on body-elements, the substances are thus to be classified under two heads, namely "increasers" of body-elements and "decreasers" of body-elements. This way of looking at the substances leads the physicians to develop two key concepts. They call these *samanya* and *visesa*.

Let us first see what these mean in the medical texts and why, as conceptual tools, these are considered crucial by the physicians. The *Caraka-samhita* introduces the concepts as follows :

> That which causes the increase of everything (of the same nature) at all times is called *samanya*, while by *visesa* meant the cause of the decrease. Thus the tendencies of the two (for increasing and decreasing the body-elements) are : *samanya* is that which combines, *visesa* is that which disunites. Hence, *samanya* is that which is similar, and *visesa* is its opposite. (i.1.44-5)

It is well-known that these two concepts acquire great importance in the Vaisesika philosophy. But it needs to be noted that in the *Caraka-samhita*, *samanya* and *visesa* mean something quite different from what these mean in the philosophical literature. We quote S.N. Dasgupta, who makes this difference very clear :

"In the Vaisesika system the word *samanya* means a class concept : but here (in medicine) it means the concrete things which have similar constituents or characteristics; and *visesa*, which means in the Vaisesika ultimate specific properties differentiating one atom from another, means in Caraka concrete things which have dissimilar and opposite constituents or characteristics. *Samanya* and *visesa* thus have a significance quite different from what they have in the *Vaisesika-sutras*. The principle of *samanya* and *visesa* is the main support of Ayurveda ; for it is the principle which underlines the application of medicines and the course of diets. Substances having similar constituents or characteristics will increase each other, and those having dissimilar constituents or characteristics will decrease each other...... Instead of having only a conceptual value, *samanya* and *visesa* are here seen to discharge a pragmatic work of supreme value for Ayurveda."[56]

Dasgupta himself is inclined to see in this view of *samanya* and *visesa* an "indebtedness" of Ayurveda to the Vaisesika philosophy.[57] "It is well to note in this connection," says he, "that the *Caraka-samhita* begins with an enumeration of the Vaisesika categories, and though it often differs from the Vaisesika view, it seems to take its start from the Vaisesika."[58] "In the case of

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[56] S. N. Dasgupta, ii. 371.

[57] *Ibid.* ii. 366.

[58] *Ibid.* 369.

samanya and *visesa*, again, Caraka seems to add a new sense to the words."[59] Such an understanding of the relation between Vaisesika philosophy and the medical theories, as we shall later see, is in need of re-examination. Historically speaking, there are grounds to think that the fundamental categories of the Vaisesika philosophy originally take shape in the medical school to meet the theoretical requirements of the practising physicians. But we have preferred to examine the question of the relation of Vaisesika to Ayurveda in a separate *Appendix*.

27. A GENERAL DESCRIPTION OF MEDICAL THEORY

We shall quote here a passage of the *Caraka-samhita*, which sums up some of the main points of the medical theory we have discussed so far, as well as adds a few more points to those already discussed. Roughly translated, the passage is as follows :

> The exact knowledge of the body subserves the purpose of maintaining its health, because it is only on the strength of the body that we can determine the factors contributing to its well-being. Hence do the experts extol the knowledge of the body.
>
> By the body is meant that combination of matter in five forms which serves as the substratum of consciousness and which (normally) maintains the balance (of the body-elements).
>
> When therefore the body-elements become discordant, the body suffers disease and even death. This tendency towards discordance of the body-elements, again, is brought about by their hypertrophy or atrophy, whether partial or complete.
>
> This hypertrophy or atrophy of the body-elements resulting from their mutual conflict takes place simultaneously, because whatever factor tends to increase one body-element tends at the same time to decrease another body-constituent which is opposed to it. (That is, when one body-element is by nature opposed to another, the increase or decrease of the former naturally leads to the decrease or increase of the latter.)
>
> Therefore, medicine is that which, when rightly administered, becomes at the same time a harmoniser of the increased or decreased body-elements. It brings down the element that has become excessive and at the same time augments the deficient one (opposed to it).
>
> Indeed, this alone is the end sought by the use of medicine as also by the observance of desirable habits. It is the balance of the body-elements, to be achieved or maintained as the case may be. It is only with the view of maintaining the balance of the body-elements that the intelligent

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[59] *Ibid*. 371.

person, while being healthy, would use by rotation a variety of dietary substances with different taste-qualities and other properties, the effects of which are ascertained to be agreeable to the body, i.e. as contributing to its balance. However, those who have to depend on one particular variety of food should endeavour to balance its over-use by physical exercise, which is known to be counteractive to it.

Right mode of living ensuring the balance of the body-elements comprises the proper performance of acts and use of diets, which are counteractive to local, seasonal and individual idiosyncrasies. It includes also the suppression of all tendencies to excess, the non-suppression of the excretory impulses, i.e. non-suppression of the tendency of the body to expel the excretions from within the body, and the avoidance of violent activities. Right mode of living comprising these, it is taught, brings about the balance of the body-elements.

The body-elements, again, increase by the repeated consumption of substances that either wholly consist of or predominate in like qualities, and those diminish by the repeated consumption of things that either wholly consist of or predominate in unlike qualities.

Here is an enumeration of the qualities of the body-elements : heavy, light, cold, hot, unctuous, dry, slow, acute, stable, mobile, soft, hard, clear, slimy, smooth, rough, subtle, gross, dense and liquid.

Of these, the body-elements that are heavy increase by the repeated intake of substances that are heavy ; these at the same time reduce the body-elements that are light. The light ones, again increase by the intake of light substances, which, at the same time, reduce body-elements that are heavy. In this manner, there is increase of body-elements by the intake of substances with like qualities and decrease of body-elements by intake of substances with unlike qualities.

Hence the body-element in the form of flesh grows more by the intake of flesh, i.e. relatively to the rest of the body-elements. Similarly, the body-element in the form of blood increases by the intake of blood ; the element in the form of fat increase by the intake of fat ; the flesh-marrow (*vasa*) by the intake of flesh-marrow ; the bones by cartilage, the bone-marrow by bone-marrow, the semen by semen and the foetus by foetus.

Now, in cases where substances of identical nature, in conformity with this rule, are not available or, even if available the substances cannot be used either because they are unsuitable or because they are disgusting or because of some other reason, and nevertheless, it is necessary to increase a particular body-element whose perfectly corresponding one cannot be used as food-substance—recourse must be taken to substitue food-substances abounding in qualities of the specific body-element the increase of which is required.

Thus, for instance, in the case of the diminution of semen, use may be made of milk and clarified butter, and also other articles listed as sweet, unctuous and cooling ; in diminution of urine, use may be made of sugar-cane juice, Varuni wine, and also substances having liquid, sweet, acid, salt and moisture-producing properties ; in diminution of faecal matter, use may be made of horse-gram, black gram, mushroom, the viscera of goats, barley, vegetables and the sour gruel of grains : in diminution of *vata,* use may be made of substances that are bitter, astringent, dry, light and cold ; in diminution of *pitta,* use may be made of substances that are sour, salt, pungent, alkaline, hot and acute ; in diminution of *kapha,* use may be made of substances that are unctuous, heavy, sweet, dense and slimy.

Recourse is to be sought also to physical exercise which stimulates a particular body-element whose growth is sought. In this manner, by the use of like and unlike substances and also by physical exercise, the increase or diminution of body-elements is to be brought about. Thus we have explained the direct and indirect methods of bringing about the increase or decrease of body-elements. (iv.6.3-11)

It is already evident from this passage that in trying to explain the theoretical foundations of therapeutic technique, the ancient physicians are confronted with a situation which is actually far more complicated than is covered by their simple formula of restoring the balance of the body-elements by increasing or decreasing some specific form of it, using natural substances with like or unlike qualities. Assuming, for example, that the use of milk, clarified butter and other articles listed as "sweet, unctuous and cooling" is observed to have an appreciable effect in curing what is called "the diminution of semen in the body", it is not easy to work out the explanation of this phenomenon in terms of the medical formula which it is supposed to illustrate. Besides, admitting that as physicians they observe the desirable effect of physical exercise for maintaining health, how can they at all hope to relate also this phenomenon to their set formula and claim that physical exercise stimulates a particular body-element even admitting that physical exercise increases "heat" within the body ? Are all these dogmatic assertions pure and simple or is there anything behind these assertions to indicate the gropings at scientific explanation on the part of the pioneers of medical science ? Before answering the question in haste, let us try to understand the way in which their mind seems to be working.

28. MEANING OF THE MEDICAL FORMULA

The *Caraka-samhita* speaks of twenty qualities of substances. The list of these begins with two antagonistic ones, which the physicians call heavy (*guru*) and light (*laghu*). What exactly is meant by these ? From their viewpoint, the answer is quite simple. They observe that certain substances are rather easily digested while it is difficult to digest certain other substances. This difference, they feel convinced, is due to the inherent nature of the substances. Thus, the substances observed to be easily digested are in their view "light by nature" (*svabhava-laghu*), while substances observed to be difficult to digest are viewed as "heavy by nature" (*svabhava-guru*). Depending on this, they do not find much difficulty in classifying the various substances under these two main groups. As the *Caraka-samhita* says,

> In view of this, *sali* rice, *sastika* rice, *mudga* or green gram, common quail, grey partridge, antelope, rabbit, wapiti, Indian sambar and such other articles of food are light by nature. . . . Similarly, cakes of flour preparations of sugar-cane juice and condensed milk, *til,* black gram, the flesh of aquatic and wetland animals and such other articles of food are heavy by nature. (i.5.1)

This much is perhaps simple observation and the lack of accuracy—if any—in this is only due to the want of controlled conditions, the importance of which takes many centuries for the scientists to realize. For the ancient doctors, however, the facts thus observed also raise a theoretical question. How are they to account for the fact that certain substances are not easily digested while others are digested easily ? In other words, what is it that makes certain substances "heavy by nature" and others "light by nature" ? The physicians are supposed to answer this question in accordance with their fundamental proposition that all substances in nature are made of matter in five forms, viz., earth, water, air, fire and *akasa*. Accordingly, after stating the list of substances "by nature light" or "by nature heavy", the *Caraka-samhita* adds that such nature of substances is not to be viewed as accidental or without cause. The fact on the contrary is that substances which by nature are light are so because of the predominance of fire and air in these, just as substances which are by nature heavy are so because of the predominance of earth and water in these. (i.5.6)

We can thus see, when the physicians speak of substances as heavy or light, they have in mind something else altogether than their weight. What they are really groping for is something more fundamental, viz. the kind of matter constituting the substances. But how is this matter-composition of substances related to the basic fact of observation, viz. that some of these are easily digested while the others are not? From the physician's viewpoint, the answer to this is to be sought in the nature of the digestive process itself. We have seen how, depending on the technological developments of their times, they are led to attach the greatest importance to the role of fire in this process. Accordingly they think that a substance made predominantly of fire adds to the fire in the body, and this makes it easily digested. But a substance made predominantly of earth and water, because of the insufficiency of fire in it, makes it comparatively difficult to digest. The fact that even such a substance is digested after all is due to the presence of fire in it also, though secondarily or in a subsidiary form. The physicians, as we have already noted, conceive every substance as made of matter in all its five forms, inclusive of fire. Thus the *Caraka-samhita* asserts, "Consequently, substances that are light stimulate by their inherent nature the fire (within body). Hence these do not cause much harm even though taken in excess." (i.5.6)

Such an understanding of the role of fire in digestion cannot but raise another problem for the ancient physicians. Interested in the well-being of the human body as they above all are, they do not fail to observe the simple fact that physical exercise also helps digestion and increases appetite. How are they to account for this fact consistently with their understanding that digestion depends on matter in its fire-form? For them there can be only one answer to this. Physical exercise must be viewed as somehow or other generating or augmenting fire within the body. So they speak of *vyayama-agni* or "fire resulting from physical exercise". This helps the digestion of "substances that are by nature heavy", which, medically speaking, means "substances that are by nature deficient in fire". Thus the *Caraka-samhita* says,

> Again, substances that are heavy—because of having contrary quality—do not by nature stimulate fire within the body. Unless therefore fire is increased within the body by physical exercise, over-eating of these is very harmful. (*Ib.*)

How are we to look at this explanation? Is it to be viewed as merely the tendency to add one assumption to another for the sake of supporting a pre-conceived theoretical view? Or, could it be that by assuming this *vyayama-agni* the physicians are also trying to take note of another fact of simple observation, namely that physical exercise makes the body hot? Evidently, to the pioneers of rational medicine, heat generated in the body is inconceivable without the assumption of the generation or provocation of fire within. The rise in body temperature etc. due to physical exercise can thus be only because of the increase of fire in the body. To the ancient physicians, this is corroborated by the further fact of simple observation, namely that physical exercise helps the digestion of substances otherwise not easily digested. With such a naive view, however, they cannot escape the simple observation of fever making the body hot. But we should not perhaps expect from them more than what was possible for them.

29. UNDERSTANDING THE SUBSTANCES: *DRAVYA*, *GUNA*, *KARMA* AND *SAMAVAYA*

We have discussed all these specially to see how the minds of the ancient scientists are possibly working. They are keen on understanding certain qualities (*guna*-s) of substances (*dravya*-s), because these are supposed to be pointers to their matter-composition. Thus, the flesh of wet-land animals like the baffalo and pig is "heavy" while that of the wapiti and sambar is "light", not because the former weighs more than the latter but because the matter-composition of the former is different from that of the latter.

Obviously enough, it requires centuries of patient research to move towards a gradually perfected knowledge of the nature of matter and of the laws of its transformation, only on the strength of which this problem of matter-composition of things can possibly be better grasped than is actually done by the ancient doctors viewing matter merely as earth, water, air, etc. What interests us, however, is to see how the theoreticians of medical science do the pioneering work not only in formulating the problem but also in developing some conceptual tools for solving it.

This theoretical work presupposes the compilation of empirical data specially about the therapeutic agents. The enormity of such data, as found in the *Caraka-samhita* and *Susruta-samhita* is already mentioned. But Ayurveda would have remained at a mere empirical level—as something like the medical lore of the tribal peoples—if the empirical data were left as such. What the theoreticians of Indian medicine attempt moreover is a systematic interpretation of all this. Of the conceptual apparatus developed for the purpose, three are most important. These are called *dravya* or substance, *guna* or quality, and *karma* or action, though—specially for explaining the relation between the substance and its qualities—the need is also felt for a fourth category, which is called *samavaya*, meaning eternal and inseparable relation. Like the *samanya* and *visesa* of the physicians already discussed, we meet also these four categories in the Vaisesika philosophy. For the present, we shall avoid the question of this philosophy being influenced by medicine or medicine borrowing from this philosophy. We shall discuss instead these categories as understood by the ancient doctors for the purpose of systematizing their empirical data.

The therapeutic agents are viewed as belonging to the general category of natural substance or *dravya*. Medically speaking, what interests the scientists most is their action or *karma* on human beings. The need for these two categories is thus quite obivous. But there is another special problem. Rejecting supernaturalism and mysticism, all substances are viewed by them as made of matter or *bhuta*. But how to determine the matter-composition of a substance, only in terms of which its action on the body is to be judged ? The ancient doctors give us the impression that in their view the qualities or *guna*-s of a substance can give us the clue to its matter-composition, and therefore also to its actions. Hence is the need for this third category, namely *guna* or quality. Accordingly a great deal of emphasis is put in the *Caraka-samhita* on the importance of these three categories for medical science. It declares,

> Thus, in this treatise are discussed the substances, qualities and actions, as promotive or otherwise of life. (i.30.23)

But how far is the procedure of judging a substance from the qualities really dependable ? It cannot at all be dependable if the relation between the two is accidental, transitory or detachable. However, the physicians think that their relation is not always so. There are cases in which the relation between the qualities and substances is peculiarly inseparable or undetachable, and in this sense eternal. A relation like this is called *samavaya*, as for example the relation between matter in its earth-form and its specific quality, which is supposed to be smell. Explaining this, the *Caraka-samhita* says, "The relation between earth etc. and their (specific) qualities is inseparable. Such a relation is called *samavaya*. It is eternal. Wherever there is a substance, there is also its (inseparable) quality. There cannot be any instance to the contrary." (i.1.50)

This relation of inseparableness or *samavaya* is therefore exceedingly important from the medical viewpoint. When such a relation exists between a quality and a substance, the former is an unmistakable pointer to the latter. Thus, for example, all sorts of qualities may be found associated with a substance. But the physician has got to determine which of these are just accidentally associated with the substance and which of these are so inseparably related to the substance that these are inconceivable without the substance : wherever the substance is, there must be these qualities or that, any case of the presence of these qualities without the substance is inconceivable. Only when the qualities are thus impossible without the substance, they are infallible indices to the nature of the substance.

But this identification of the nature of a substance by its inseparable qualities is for the physician only a means to an end. The end is to know—and thereby to regulate—the action (*karma*) of the substances on our bodies. This action is determined by the inherent nature of the substance, i.e. by its matter-composition. Thus the qualities apart, there exists in the substance also its specific action.

From the medical viewpoint, therefore, the substance is the substratum not only of its inseparable qualities but also of its inseparable action. The specific action of a substance is no more detachable from it than its specific quality. If it is impossible for a substance to exist without its specific quality, it is also inconceivable for it to be without its specific function or action. The nature of a substance, once identified by its inseparable qualities, can thus be effectively recommended by the physician for regulating the change required for the body. This means that though both the inseparable quality and the inseparable action have for their substratum the same substance, the status of the former is quite different from that of the latter. The inseparable quality of a substance is only a passive pointer to the nature of the substance. But the medical effect of a substance is due to the function it has because of its inherent matter-composition. As the *Caraka-samhita*, in the course of explaining the basic theoretical principles of medicine, asserts :

> Substance is that which serves as the substratum of the actions and qualities related inseparably to it. The quality, though inseparably related to the substance, is the cause only in the passive sense. As residing in the substance, that which serves as the (real) cause of conjunction or disjunction (of the body-elements) is action (*karma*), by which is meant its actual function. This action is not determined by anything else (than the inherent nature of the substance itself). (i.1.51-2)

Karma or action is thus the function of a substance inherent in it. It has two forms, called conjunction (*samyoga*) and disjunction (*vibhaga*), which, as we have repeatedly seen, mean the addition and diminution of some particular form of body-matter. We have also seen that from the viewpoint of these two forms of functions, the natural substances, in relation to body-elements, are technically called *samanya* and *visesa*. A substance causing conjunction to a specific from of body-element—i.e. as adding to it—is *samanya* in relation to this body-element. A substance causing disjunction to a specific form of body-element—i.e. as diminishing it—is *visesa* in relation to this body-element. These two complete the list of the six categories, viz. *dravya* (substance), *guna* (quality), *karma* (action), *samavaya* (inseparable relation), *samanya* (similar, alternatively also called *vrddhi-karana* or "the cause of increase") and *visesa* (dissimilar=*hrasa-hetu* or "the cause of diminution"). These then are the basic conceptual tools with which the ancient theoreticians of medicine try to systematize a vast stock of empirical data concerning the natural substances consumed and of the ways in which these variously affect our body-elements.

30. BHARADVAJA : AN EARLY THEORETICIAN

With this list of the six categories, we can now try to understand what otherwise appear to be two strange features of the extant *Caraka-samhita*.

First, the history of Ayurveda, with which the medical compilation begins. Shorn of the mythological elements, it mentions a certain Bharadvaja as the earliest authority on medicine.

Strangely, however, instead of attributing to him any discourse on health, disease and drugs—which is only normally expected of such an authority—the text attributes to him a very cryptic statement, the essence of which is the enumeration of these six categories (i.1.28-9). Though apparently extremely peculiar as an account of an outstanding event in the history of Indian medicine, the presmuption is that this cannot be without some very good reason. This reason, as we have just seen, is the importance of these categories for the theoretical fundamentals of Ayurveda. In other words, the medical compilation seems to retain in its own way the memory of a very early theoretician of the medical school—in fact the first that our text is aware of—who strives after a systematic understanding of an aggregate of empirical data before him. The vastness of this empirical data leads us to presume that these could be compiled only by generations of ancient healers—the "roving physicians" or *caraka*-s or *carana-vaidya*-s exploring a wide geographical area in search of the healing agents. Admitting this, from the viewpoint of the *Caraka-samhita* the genius of Bharadvaja consists in his developing or using the conceptual apparatus suitable for the systematization or theoretical understanding of this data. The conceptual apparatus consists of the six categories—*dravya*, *guna*, *karma*, *samavaya*, *samanya* and *visesa*—the enumeration of which is therefore only expected of him. Thus the cryptic statement of the *Caraka-samhita*, according to which Bharadvaja is supposed to expound to the assembly of doctors the view of these six categories may as well be very relevant from the viewpoint of the history of Indian medicine.

But does Bharadvaja develop the view of these categories or does he simply adopt it from some pre-existing philosophy? We cannot ignore this question because, as it is well-known, these categories constitute the essential theme of the Vaisesika philosophy. Nothing is therefore easier for the historian of Indian philosophy than to assume that the ancient physicians borrow extensively from the Vaisesika philosophers for the purpose of providing medical science with a philosophical foundation. But many difficulties are involved in such an easy assumption. For the present we shall note another peculiarity of our extant *Caraka-samhita*.

In spite of paying great tribute to Bharadvaja as the earliest theoretician of Ayurveda, the opening chapter of our *Caraka-*

samhita abruptly stops saying anything more about him. The text returns to him much later (iv.3), though this time with the purpose of urging him to renounce his heretical views in favour of an ideology approved of by Indian orthodoxy. Why is this peculiarity of the text ?

We have perhaps a clue to this in the passage of the *Caraka-samhita* we have quoted last. It ends with the assertion that the action of a substance is determined exclusively by the substance itself and it is not influenced by anything else : *karma na anyat apeksate* (i.1.52). Why is this emphasis on the exclusion of any other factor as possibly influencing the action of a substance on the human body ? Could it be because of the anxiety to disown the view of supernatural causation widely current in ancient India—specially the view that human happiness or suffering is determined by the "unseen" (*adrsta*) hangovers of actions performed in past lives ? According to this view, even when a particular drug is observed to cure a specific disease, the cure is not really due to the intrinsic efficacy of the drug itself but to the *adrsta* of the patient, the drug having at best the status of an auxiliary at the service of *adrsta*. In any case, there can be no doubt that the emphatic claim of the ancient doctors that the action of a substance is determined by the substance itself leaves no scope for any supernatural view of the efficacy of a substance being influenced in any way by *adrsta* or god or any other factor like that. With this rejection of the possible supernatural views, what can the doctor be left with ? There is only one answer to this. It leaves him with a purely naturalistic view of the actions of substances—the view that the *svabhava* or the inherent nature of a substance produces its specific result.

Though such a view is strongly condemned as heretical by Indian orthodoxy because of its overt materialist implications, it cannot but be a fundamental proposition for defending the intrinsic efficacy of medicine—a point on which the ancient Indian doctors are most keen. The view of *svabhava*, in other words, belongs to the theoretical fundamentals of Ayurveda.

We can perhaps now understand the second peculiarity of the *Caraka-samhita* we have just mentioned. If it remembers Bharadvaja as the earliest theoretician of Indian medicine and if the view of *svabhava* is required by the basic theoretical position of Ayurveda, the possibility of Bharadvaja having been a defender of this view cannot be easily ruled out. To the later "reconstructors" of our *Caraka-samhita* such a possibility—or perhaps some ancient tradition actually attributing the view of *svabhava* to Bharadvaja—must have been extremely embarassing, because of the intense contempt of Indian orthodoxy for this view. What then can they do but to insert a special chapter into the medical compilation, describing how Atreya—the pious spokesman of Ayurveda—urges Bharadvaja to renounce his heretical view, which is specially the view of *svabhava*? This precisely forms the theme of the entire third chapter of the Sarira-sthana of our *Caraka-samhita*.

31. DISEASES : *VAYU, PITTA* AND *KAPHA*

From what is already discussed, it is clear that two problems are crucial for our ancient physicians. First, in the case of every disease, they have to determine the nature of the matter-imbalance in the body causing it. Secondly, they have to identify some substance or combination of substances the matter-composition of which is such that—when transformed within the body—it should rectify the said matter-imbalance.

It is evident for us today that both the problems are immensely more complicated than can possibly be solved with the *panca-bhuta* theory or the view of matter as earth, water, air, fire and *akasa*. For the pioneers of medical science, however, there is no possibility of developing a more adequate understanding of the nature of matter. In so far as they are lured by the fascination for a theoretically complete explanation of diseases and drugs on the strength of this view of matter, they run the risk of being drifted towards a schematic understanding of both.

After the decadance of Indian medicine, such schematic understanding increasingly assumes the form of dogmatic formulas indiscriminately used specially in diagnosis and even in therapeutics, though what saves the latter at least partially is the undercurrent of vitality derived from the empirical knowledge once acquired by the physicians. This aspect of Ayurvedic theories has naturally no abiding interest for us. We shall mention it very briefly and then return to the general features of science-consciousness with which rational medicine (*yukti-vyapasraya bhesaja*) begins in ancient India.

The schematic form of Ayurvedic theories and their eventual dogmatic degeneration is obvious in the formulas of *vayu, pitta* and *kapha*, with which the causes of all diseases are sought to be explained. We have already seen what these mean. Food consumed undergoes a twofold transformation, called the nourishing substance or *prasada* and excrements or *mala*. The latter include *vayu*, *pitta* and *kapha*, meaning wind, bile and phlegm. It seems that in a large number of diseases the physicians observe that there is an abnormal accumulation of one or more of these waste-products of food in the body. Hence they think that, though in their normal proportion even these waste-products of food are essential for the maintenance of the proper balance of body-constituents (i.29 ; i.28.4), the excess of any of these—which usually causes the abnormal diminution of the others—results in various diseases. But the physicians do not remain satisfied with this view. They seem to strive after a universal solution of the problem of aetiology of all diseases. So they seem to drift towards some set formulas of *vayu*, *pitta* and *kapha*, in terms of which the origin of all diseases is imagined to be explained. Already in the *Caraka-samhita* and *Susruta-samhita* in their extant forms this tendency becomes highly prominent. But Vagbhata[60] says that Kapilabala—the father of the final "reconstructor" of our *Caraka-samhita*—developed his own understanding of *vayu*, *pitta* and *kapha*. So we cannot outright reject the possibility of these three waste-products of foods acquiring increasing prominence in the medical compilations from those through whose hands these pass before assuming their present form· In any case, what we read about *vayu*, *pitta* and *kapha* in the extant medical compilations is on the whole a bundle of dogmatic assertions that become all the more cumbrous, arbitrary and often mutually conflicting in the later commentaries and digests on Ayurveda. Readers interested in this aspect of the Ayurvedic view are referred to Dasgupta,[61] who has discussed it in detail.

What perhaps interests more the historian of Indian science is another point. In spite of the arbitrariness and dogmatism caused in the medical view by the ever-increasing importance attached to the formulas of *vayu*, *pitta* and *kapha*, the medical compilations retain for us evidences also of a broader—and perhaps earlier—view according to which any excess or diminution of the body-constituents caused by food transformed both as nutritional substances (*prasada*) and excrements (*mala*) results in disease. We have already quoted long passages of the *Caraka-samhita* expressing this pre-schematic view of disease and health, which is nearer the general materialist hypothesis concerning the interaction between environmental matter and body-matter. This hypothesis seems to contain much greater science potential : instead of dragging the medical theory to some dogmatic dead-end, it can attract the doctors to probe deeper into the problem of the nature of matter and thereby pave the path for creative development of medical theory.

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[60] *Astanga-Samgraha*, KSS ed. p. 193.

[61] S. N. Dasgupta HIP ii. 319-39.

But the ancient physicians fail to develop an insight into the nature of matter deeper than the view of it as earth, water, air, etc., with which they try to understand the matter-composition of all substances in nature and of their transformations in the body. This, to say the least, is too ambitious for the ancient scientists. In trying to arrive at a complete solution of the problem, the obvious risk again is that of being drifted to certain schematic formulations. The source-books of Ayurveda show how serious is the risk, because the texts do strive after certain arbitrary conclusions only with a deceptive appearance of completeness. What partially saves this aspect of Ayurvedic theory from degenerating into dogmatism is the physicians' fidelity to the observation of facts.

32. DRUGS : *RASA, VIRYA, VIPAKA* AND *PRABHAVA*

The physicians try to understand the nature of substances depending mainly on their qualities. What is apparently peculiar is that the *Caraka-samhita* enumerates the qualities in two separate lists. The first of these lists—mentioned as 'sound etc.'—contains five qualities, viz, sound, smell, touch, colour and taste. The second list—cryptically called 'heavy etc. ending with the liquid'—contains twenty qualities, viz. heavy, light, could, hot, unctuous, etc. Our first question naturally is : Why, instead of one list of twenty-five qualities, does the text give two separate lists ? The answer is that there is obviously some basic difference between "qualities" as understood in these two lists. The qualities of sound etc. are directly perceived by the sense-organs ; but the qualities in the other list are not so. We have already discussed two of these viz. light and heavy, and we have seen that these mean easy digestibility or otherwise of a substance. This easy digestibility or otherwise of a substance, it needs to be noted, does not belong to the category of "action" (*karma*), by which is meant the medically significant change produced by the substance in the body-constituents.

Thus the "action" of buffalo-flesh, which is considered "heavy", is that it "promotes firmness and corpulence of the body and it gives energy and sleep" (i.26.80-1). The flesh of wapiti and sambar is by contrast "light", as belonging to the *jangala* class of animals (i.27.45-6) their flesh has the "action" of restoring the balance of the body-elements when their disturbance is due to the excess of bile and deficiency of phlegm. (i.27.59-60)

Thus "light" and "heavy", though having the substance as their substratum, do not belong to the category of "action" and are hence considered "qualities". But these are qualities not in the sense of being directly apprehended by the sense-organs, as sound, colour, teste, touch etc. are. "Light", "heavy" etc.—and therefore also the other eighteen qualities mentioned in this list—are qualities in some technical sense immediately relevent for medical purposes. Hence the *Caraka-samhita* wants to equip the physicians with the knowledge of these. Here are only a few of the hundreds of examples we read in the text. (i.27)

The *sastika* rice is cold, unctuous and light, while the *vrihi* rice is heavy. The common millet is light and cold and so is barley ; but wheat is unctuous and heavy. Among the pulses, green gram is dry, cold and light though black gram is unctuous, hot and heavy. The flesh of the five classes of animals called "tearer", "burrower", etc., is heavy, hot and unctuous but those of the *jangala* animals is light and cold. The flesh of the goat is not very cold nor very heavy nor very unctuous while that of the sheep is heavy and cold. The milk of animals with uncloven hoof is hot and dry, that of the goat is cold and that of the sheep is hot. And so on.

From what we have discussed about "heavy" and "light" there are grounds to think that the twenty qualities mentioned in this list are supposed to be pointers to the matter-composition of substances, and the *Caraka-samhita* gives us the impression that the view of these is arrived at by the observation of the various effects of substances on our bodies. Once therefore the physicians can prepare a ready reckoner of different substances having these qualities, there is hope of easily solving their problem of prescribing the appropriate drug or diet for the patient. But since these qualities are not directly apprehended by the sense-organs, these cannot solve the problem of identifying the nature of a substance from its qualities. It seems that for this purpose the physicians feel obliged to depend on the qualities mentioned in the other list, viz. sound, smell, taste, touch and colour.

It is obvious, however, that all these sense-qualities cannot be equally important or equally essential for the purpose of identifying the nature of a substance. At any rate, the physicians somehow feel convinced that of these sense-qualities, the most important one is taste, which they call *rasa*. Hence is the great importance of the view of *rasa* or taste-quality in the medical theory of natural substances.

It needs immediately to be noted that in the context of nature or natural substances, the word *rasa* means something else than what it means in the context of the body. In the latter context, it means the "organic sap" produced from the digested food. But what is meant by *rasa* in the context of nature or natural substances ? It is evident from the *Susruta-samhita* (i.40) as well as *Caraka-samhita* (i.26.8) that there is a great deal of confusion and controversy on this question among the ancient physicians. The *Caraka-samhita* contains in fact the account of a long debate on it, in which no less than ten different authorities express widely different views of the *rasa*-s (i.26). But the text wants us to give the impression that out of this chaos of divergent views, some standardized understanding of *rasa* evolved in the medical school. It is summed up as follows :

> *Rasa*-s are only six—sweet, sour, salt, pungent, bitter and astringent... Their substrata are the substances resulting from five forms of matter as transformed by their nature (*prakrti*), the laws of their modification (*vikrti*) and combination (*vicara*), as well as the influences of place (*desa*) and season (*kala*). In these substances exist the qualities (*guna*-s) called heavy, light, cold, hot, unctuous, dry, etc. (i.26.9)

Elsewhere, the text defines *rasa* as that which is apprehended of a substance when our tongue comes in first contact with it (i.26.28). Further, we are told, "By *rasa* is meant the object of the gustatory sense. It has for its origin water and earth, though in special cases also the other three, viz., *akasa*, etc. (i.1.64).

There is thus no doubt that, in the context of natural substances, *rasa* means taste-quality, though for the purpose of identifying the nature of a substance it is considered so important that the text often figuratively uses the word *rasa* to refer to the substance in which it inheres.[62]

Such then is the position of the ancient physicians. It is imperative for their therapeutic purpose to understand the nature of the various substances of the world, which they have to prescribe as diets or drugs. But the only possibility they find open for this purpose is to depend on their tastes or *rasa*-s, which are in fact considered so important as almost to be interchangeably used for the substances in which these inhere. Accordingly, great care is taken by both *Caraka-samhita* (i.26.74-9) and *Susruta-samhita* (i.40.10 B) to instruct the doctor how to determine these taste-qualities of substances. There is also the effort to correlate these taste-qualities with the twenty other qualities called "heavy", "light", etc. Thus the *Caraka-samhita* formulates.

> As regards the quality called dry (*ruksa*), the astringent taste possesses it in the highest degree, the pungent in the moderate degree and bitter in the minimum degree. Similarly, as regards the hot (*usna*) quality, salt possesses it in the highest degree, sour in moderate degree and pungent in the lowest degree. As regards the unctuous (*snigdha*) quality, the sweet taste possesses it most, the sour taste moderately and the salt taste the least. Regarding the cold (*sita*) quality, sweet taste possesses it in the highest degree, astringent in moderate degree and the bitter in the lowest degree. With reference to heavy (*guru*) quality, sweet taste possesses it in the highest degree, the astringent in the moderate degree and the salt in the lowest degree. As regards light (*laghu*) quality, the bitter taste possesses it in the highest measure, pungent taste in moderate measure and the sour taste in the lowest measure. (i.26.53-6)

There is also the attempt in both *Susruta-samhita* (i. 42.1-4) and the *Caraka-samhita* to explain the origin of the taste-qualities in different substances in terms of the view of five-fold matter. We quote here from the *Caraka-samhita*, in which Atreya says,

> I shall now explain the origin of the six tastes from the five forms of matter (*panca bhuta-prabhavah rasah*).
>
> Water originating in the sky is by nature pure (*saumya*), cold, light and without any manifest taste. However, while falling from the sky—

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[62] S. N. Dasgupta HIP ii. 361 quotes Cakrapani : *rasah iti rasayuktani dravyani.*

> and after having thus fallen—it gets endowed with the characteristics of the five forms of matter, and sustains the bodies of all creatures—both the immovable ones (*sthavara*=plants) and movable ones (*jangama*=animals). In these bodies become manifest the six *rasa*-s.
>
> Of these six *rasa*-s, sweet is due to the predominance of water, sour is due to the predominance of earth and fire, salt is due to the predominance of water and fire, pungent is due to the predominance of air and fire, bitter is due to the predominance of air and *akasa* astrigent is due to the predominance of air and earth.
>
> Thus originates the distinctness of the six tastes from the paucity or predominance of the five forms of matter, in the way in which the peculiarities of colour and form originate in all the living creatures, both immobile and mobile (i.e. from the same five forms of matter). (i.26. 39-40)

For the practical purpose of the doctor, however, what is supposed to be most important is the table of actions and other qualities of the different substances according to the predominance of the taste-qualities or *rasa* in these. Both the *Susruta-samhita* (i. 42.11-16) and the *Caraka-samhita* prepare such a table. We quote here the one given in the *Caraka-samhita* :

> Among these six *rasa*-s, the sweet taste (i.e. a substance with *madhura-rasa*), being homological with the body-constituents, increases 'the organic sap', blood, flesh, fat, bone, marrow, 'corporeal vigour' (*ojas*) and semen. It promotes life and invigorates the sense-organs. It adds to strength and complexion, destroys *pitta,* poison and *vayu,* alleviates thirst and burning seansations. It has a beneficial effect on skin, hair, voice and strength. It promotes cheerfulness, vitality and satisfaction, makes the body plump and firm, mends pectoral lesions, activates the functions of the nose, mouth, throat, lips and tongue. It removes internal burning sensations and fainting. It is extremely attractive to the bees and ants. It is unctuous, cold and heavy.
>
> In spite of these desirable qualities, if exclusively or excessively taken, it produces corpulence, softness, lethargy, hypersomnia, heaviness, loss of appetite or weakness of digestive fire, excess of flesh in mouth and throat, respiratory trouble, cough, coryza, intestinal torpor, algid fever preceded by cold. It causes constipation, and undesirable sweet taste in the mouth, vomiting, loss of consciousness and of voice ; deradenoncus, chain of deradenoncuses, elephantiasis ; swelling of throat ; increase of mucus ; discharge from bladder, vessels and throat ; eye-diseases with excessive mucus ; and similar other morbid conditions caused by the excess of *kapha*.
>
> The sour taste (i.e. a substance with *amla-rasa*) adds relish to the food, increases digestive fire and thereby builds up the body and invigorates it. It improves mental function (*manah bodhayati*), sharpens the sense-

organs, promotes strength and increases *vayu*. It stimulates the heart (*hrdayam tarpayati*), increases salivation and thereby helps what is eaten to move downwards. It moistens, digests and gives pleasure. It is light, hot and unctuous.

In spite of these desirable qualities, if exclusively or excessively taken, it sets the teeth on edge, causes morbid thirst, flinching of eyes and horripilation. It dissolves *kapha* and increases *pitta*, vitiates blood, makes the flesh sluggish and the body flabby, causes oedema in those that are thin, cachectic, emaciated and debilitated.

Besides, because of its fire content, it causes pus formation in injuries due to wound, contagious bites, burns, fractures, swelling, dislocations, toxic urine or contact in other forms with venomous creatures, bruise, excision, incision, separation, puncture, crushing etc. In the throat, chest and heart, it causes a general burning sensation.

The salt taste (i.e. a substance with *lavana-rasa*) is digestive, liquefacient, appetising, defluxion-inducing, depletive and disruptive. It is acute (*tiksna*), mobile (*sara*) and radinat (*vikasi*). It is laxative and deobstruent. It cures *vayu*, stiffness, obstruction and accumulations. It overpowers all other tastes and increases secretion in the mouth. It liquefies mucus-secretion, cleans the passages, softens the body-limbs, gives relish to food and is always used in food. It is neither very heavy nor very unctuous and it is hot.

In spite of these desirable qualities, if exclusively or excessively used it provokes *pitta*, over-increases blood, causes morbid thirst, fainting, great heat, disruption and corrosion of flesh. It causes skin-diseases, aggravates toxicosis, causes rupture to swellings and premature fall of teeth. It causes sexual impotence, impairs the functions of the sense-organs, induces premature wrinkles, grey hair and baldness...

The pungent taste (i.e. a substance with *katu-rasa*) purifies the mouth, stimulates gastric fire, desiccates the food, causes water to run from nose and eyes, invigorates the sense-organs, cures intestinal torpor, oedema, obesity, urticaria, excessive fluidity and unctuousness. It causes perspiration, softening and elimination of excreta. It adds relish to food, cures pruritus, removes excessive granulations and intestinal worms, lacerates the flesh, splits open the accumulation of blood, removes obstructions, dilates the passages and subdues *kapha*. It is light, hot and dry.

In spite of these desirable qualities, if exclusively or excessively taken, it impairs sexual potency, induces stupefaction, causes weariness, asthenia, emaciation, fainting, flexion, choking, giddiness, general burning sensation in the throat, excessive heat in the body, diminution of strength and morbid thirst...

Further, because of the predominance of fire and air in it, it leads to various kinds of disordered *vayu* affecting the legs, arms, sides and back, which are attended with giddiness, burning sensation, tremors and pains in the forms of pricking and stabbing.

> The bitter taste (i.e. a substance with *tikta-rasa*), though unpalatable, removes the general aversion for food. It is an antidote to poison and it destroys the intestinal worms. It cures fainting, burning, itching, skin diseases and morbid thirst. It makes the skin and flesh firm, cures fever, increases appetite, helps digestion and purifies breast-milk. It dries up moisture in fat, flesh-marrow, bone-marrow, lymph, pus, sweat, urine, faeces, *pitta* and *kapha*. It is dry, cold and light.
>
> In spite of these desirable qualities, if exclusively or excessively taken —because it is by nature rough, clear and dry—it dries up the organic sap, blood, flesh, fat, bone-marrow, and semen. It makes the body channels shrink, saps up strength, causes emaciation, weariness, fainting, giddiness. It dries up the mouth and leads to various disorders of *vayu*.
>
> The astringent taste (i.e. a substance with *kasaya-rasa*) is soothing and constipating. It sustains the body-elements, makes the swelling to shrink and the boils etc. to subside. It causes dryness and obstructions, reduces *kapha*, blood, *pitta* and other defiling elements in the body. It is dry, cold and heavy.
>
> In spite of these desirable qualities, if exclusively or excessively taken, it dries up the mouth, afflicts the heart, distends the stomach, adversely affects the voice, constricts body-channels, causes cyanosis and impairs sexual potency. It first retards and then only slowly allows the digestion of food. It inhibits the passing of flatus, urine, faeces and semen. It causes emaciation, weariness, thirst, stiffness. Further, because it is by nature rough (*khara*), clear (*visada*) and dry (*ruksa*), it causes various diseases due to *vata*, such as hemiphlegia, spasm, convulsion and facial paralysis. (i.26.43)

In trying to follow these principles, the physicians are confronted with a practical problem. Most of the substances of nature are found to possess more than one *rasa*. So they prepare a list of sixtythree prominent types of substances possessing one or more *rasa*-s : 15 in which 2 *rasa*-s predominate (*dvirasani dravyani*), 20 in which 3 *rasa*-s predominate, 15 in which 4 *rasa*-s predominate, 6 in which 5 *rasa*-s predominate, 6 in which a single *rasa* predominates and 1 in which all the 6 *rasa*-s are prominent (i.26.15-17). This, they hope, serves the basic practical requirements of the doctors :

> In this manner are the substances divided into sixtythree groups according to the distribution of tastes. This number of sixtythree swells into an incomputable figure if the after-tastes are taken into count ; likewise if the comparative and superlative degrees of tastes are taken into consideration, the sum goes beyond computation.

In view of the above, the experts conversant with the science of tastes have limited the practical requirements of medicine to 57 groups of combined tastes and 63 groups of all tastes, single or combined.

The physician desirous of success, considering well the nature of the disease and the action of the remedy, must prescribe either a single taste or a combination of tastes as required.

According to the disease, substances of two more tastes or of combination of multiple tastes or of one only are used by wise physicians. (i.26. 22-26)

The medical problem would have been quite simplified had such an understanding of substances based on their tastes been really adequate for the physicians' purpose. But the medical compilations give us a different impression. The ancient doctors themselves feel that, while trying to grapple with the problem of the effects produced by the substances in our bodies, they are confronted with a situation which is far more complicated than is covered by the formulations just quoted. Hence the texts introduce the concepts of *virya* or "potency-in-chief for producing medical effects", of *vipaka* or post-digestive change of a substance within the body and even of *prabhava* or some peculiar operations of the substances on us, which, being frankly beyond the depth of their understanding, are viewed as mysterious. As Dasgupta observes,

"As none of the chemical effects (in the modern sense) of medicines on human organs were known, the most obvious way in which the medical effects of herbs, roots, etc., could be classified was on the basis of taste...... But it is obvious that such a classification, though simple, could not be universally true ; for though the taste is some indication of the medicinal property of any substance, it is not an infallible one. But no other mode of classification was known ; it was supposed that the taste (*rasa*) of some substances changed altogether after digestion and that in such cases the taste which changed after digestion (*paka*) would be operative...... But even this was not sufficient, for there were many other effects of medicine which could not be explained on the above suppositions. In explaining this, the theory of *virya* was introduced...... It was only in the cases where no sensible data of any kind could be found to indicate the medical properties of the thing that the idea of *prabhava* was introduced. The chapters in Ayurveda on *dravya* and *guna* deal with the enumeration of *prabhava* and also of *rasa*, *vipaka* and *virya*, wherever there is a divergence among them, *as determined by empirical observation.*"[63]

Emphasis is added above to show what at least partially saves the physicians' view of substance from dogmatic degeneration, into which their view of diseases obviously sinks. It is, in short, the fidelity to empirical data. This leads them to realize that the theory of the physiological effects of substances identified by their taste-qualities is in need of degeneralization. As the *Caraka-samhita* admits :

> Some substances with sour taste are observed to be constipative, while other substances with the same sour taste are observed to be laxative. Thus, for example, both wood apple (*kapittha*) and *emblic myrobolan* (*amalaka*) are sour in taste. But the former is constipative and the latter laxative. Again, though substances with pungent taste are contra-aphrodisiac, long pepper (*pippali*) and dry ginger are aphrodisiacs. Substances with astringent taste are constipative... but *chebulic myrobalan* is otherwise. Therefore, all substances are not to be judged by their tastes alone, because, as we have just seen, substances may possess the same taste and yet differ from each other in medicinal properties. (i.26.50-52)

One way in which the doctors amend their general theory of how substances affect our body is to introduce the concept of *vipaka*. Roughly it means the post-digestive change of a substance. Thus, though generally speaking the way in which a substance affects our bodies is to be judged by its taste, the doctor has also to take note of the transformation of the nature of the substance resulting from the process of its digestion. A substance with sweet taste may retain the usual properties of a sweet substance even if it is digested, but the process of digestion may also change it so basically as to make it acquire the properties usually characteristic of a substance, say, with sour taste. In Ayurvedic terminology, the former would be a case of *vipaka* of sweet into sweet, while the latter a case of *vipaka* of sweet into sour. The physicians hope to see some general rules concerning even this phenomenon called *vipaka*. The *Caraka-samhita* formulates :

> Generally speaking, substances with pungent, bitter and astringent taste are, on post-digestion, changed into substances having ordinarily the pungent taste. Substances with sour taste remain after digestion substances

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[63] *Ibid.* ii. 365-6.

> with sour taste, and so also the *vipaka* of sweet is sweet. By *vipaka*, however, substances with salt taste are transformed into substances with sweet taste. (i.26.57-58)

But the doctors apparently realize that such a formulation cannot be mechanically followed. The better course is to study as far as possible the *vipaka* or post-digestive changes of different concrete cases. Here are a few examples of innumerable studies like this (i.27.10ff):

Though many varieties of rice are sweet both by taste and post-digestive effect, the *vrihi* rice is "sweet in taste and acid on post-digestion." The flesh of iguana is astringent and pungent in taste, but it becomes sweet by *vipaka*. The flesh of pangolin is sweet and sour in taste, but it becomes pungent by *vipaka*. The flesh of green parakeet is astringent and pungent in taste, but it becomes pungent by *vipaka*. The flesh of the black buck is sweet both in taste and by *vipaka*. And so on. The full list of such instances mentioned by the *Caraka-samhita* would indeed be a long one.

Apparently, the medical effects of the large variety of substances as actually observed by the ancient physicians are not fully explained by the assumption of taste (*rasa*) and post-digestive change (*vipaka*). It seems that this leads them to introduce another concept, which they call *virya*. Dasgupta translates it as "potency-in-chief for producing medical effects". The *Caraka-*samhita defines it as that by which a substance acts on our bodies (*yena kurvanti tat viryam,* 1.26.13) and adds :

> The taste of a substance is felt when the substance first comes in contact with the tongue, the *vipaka* of a substance is felt when the substance produces its final effect. But the *virya* of a substance is felt throughout its presence in the body, beginning with the first contact of the substance with the tongue (i.26.66).

Apparently, the *virya* or potency of a substance is medically much more important than its taste (*rasa*) and post-digestive effect (*vipaka*).

The ancient doctors do not give us the impression of a clear and agreed understanding of potency or *virya*. But there are some indications in the medical compilations from which we may perhaps guess what they are groping for. The *Caraka-samhita* says :

> According to some, potency has eight forms. These are soft (*mrdu*), acute (*tiksna*), heavy (*guru*), light (*laghu*), unctuous (*snigdha*), dry (*ruksa*), hot (*usna*) and cold (*sitala*). According to others, potency has two forms. These are hot and cold. Potency is that by which a substance actually acts. Shorn of potency, there is no action at all. All actions are due to potency. (i.26.64-65)

We have already come across in the *Caraka-samhita* what is mentioned here as the different forms of potencies or *virya*-s, which, according to some, are eight while according to others are two. But these are mentioned elsewhere as belonging to the list of "twenty qualities". Of these we have discussed two, viz. "heavy" and "light", and we have seen that these are called "qualities" not in the ordinary sense of being the direct objects of sense-organs, but in the technical sense of being pointers to the matter-composition of substances : a substance with the predominance of fire and air is "light", while one with the predominance of earth and water is "heavy". Not that the *Caraka-samhita* provides us with any exhaustive discussion of the kind of matter-composition indicated by the other "qualities" included in the same list. Since, however, the evidence of what is clear cannot be set aside by what is not so, what is on the whole clear in the case of "heavy" and "light" leaves us with the presumption that by the other eighteen "qualities" of the same list the ancient physicians are trying to understand in their own way the matter-compositions of various substances. If so, what are called "qualities" in this list—or the more prominent ones in the list—are only likely to be viewed as forms of the real potency or *virya* of substances, because in the medical view all substances are made of matter and hence whatever action a substances may have must be ultimately determined by its matter-composition. In other words, once the substances are viewed as made essentially of matter, the peculiar potency or *virya* of a substance can only be so because of its peculiarity of matter-composition.

We do not expect the ancient dotors to work out a comprehensive view of the actions of different substances as determined by their matter-composition. Neither in the *Caraka-samhita* nor in the *Susruta-samhita* we read of any systematic attempt at it. But the doctors find it impossible to evade the question of how all sorts of natural substances act on our bodies. In trying to answer this with their views of *rasa* (taste), *vipaka* and *virya*, they want to evolve some formula correlating the three. Such a formula in the *Caraka-samhita* is : A substance which is sweet in both *rasa* and *vipaka* is "cold" in potency, while a substance which is either sour or bitter in both *rasa* and *vipaka* is "hot" in potency (i.26.45). Apart from the difficulty evidently felt by the text to be very clear about the nature of matter-composition indicated by "cold" and "hot", the fact remains that the ancient doctors themselves realize that such a formula cannot be fully tenable, inasmuch as it often fails to agree with what is actually observed by them. Thus, for example, the flesh of aquatic and wet-land animals is sweet in taste but "hot" in potency, as are many other cases actually observed to go against the formula (i.26.48-9). Hence the *Caraka-samhita* warns the doctors against mechanically relying on the formula (i.26.48). Hence again we also see how the empirical data partially save the medical theory of substances and their actions from dogmatic degeneration.

All this brings us back to one of the main points we have been trying to emphasize. To the theoreticians of Indian medicine comes down an enormous amount of empirical data compiled presumably by generations of ancient healers, who might have been the roving physicians—the *carana-vaidya*-s or *caraka*-s—from whom our medical compilation receives its name. These theoreticians, in trying to build up a rational system of medicine outgrow the old standpoint of magico-religious medicine. Thus rejecting supernaturalism and mysticism, they are led to view all healing agents simply as material substances of nature. These healing agents are mostly intended to be consumed by the patients and hence—excepting for some preparations of oils, pastes, etc. recommended for external application—the medical compilations want on the whole to identify drugs with diets. According to the *Caraka-samhita*, a synonym for *bhesaja* or medicine is *pathya* or food (vi.I-iii.3). Hence is the great importance of food in the medical view. It is food in the form of various natural substances that goes to the making of man and determines his conditions called health and disease. But these natural substances are made of matter, hence also everything about man. This leads the ancient physicians to realize that the crux of the medical problem is that of the interaction between environmental matter and body-matter.

Historically, however, this materialism is inevitably a naive one. The ancient doctors are only beginning to understand the nature of matter. They are in no position to ge deeper than the view of it as earth, water, air, fire and *akasa*. All this enables us to see the grandeur as well as the limitations of their theories. Their realization of the profound significance of the interaction between environmental matter and body-matter is of abiding importance for the history of science. But the attempt to solve the problem of this interaction in terms of *panca-bhuta* theory is the most serious limitation of Ayurveda. This limitation becomes particularly serious in so far as the doctors are lured by the fascination for theoretical completeness, which creates for the medical theories the risk of dogmatic degeneration. The effort to understand all substances of nature with the theory of matter in five forms is just impossible, though in this case what seems partially to save the medical theory from dogmatism is its strong mooring is empirical data. Though trying to determine the nature of substances and their medical effects by the tastes (*rasa*-s), the ancient doctors feel the need of introducing the concepts of *vipaka* and *virya* so that their theory can retain fidelity to what is actually observed about the effects of various substances on our bodies. But even such amendments do not fully succeed. While trying to remain true to their empirical data, the theoreticians of ancient medicine have virtually to confess that the way in which enviornmental matter acts on body-matter is often beyond the depths of their understanding.

This is evidenced by their theory of *prabhava*, which Dasgupta translates as "the mysterious operation of a medicine acting in an unaccountable way".[64] Here is what the *Caraka-samhita* says about *prabhava* :

> When, in spite of the similarity between taste (*rasa*), potency (*virya*) and post-digestive change (*vipaka*), two substances are actually observed to differ in their actions—such difference is to be accounted for by the *prabhava*. Thus, for example, *citraka* (*Plumbagozeylanica*) is pungent in taste (*rasa*) as well as in post-digestive effect (*vipaka*), and it is hot in potency (*virya*). So also is *danti* (*Baliospermum monpanum*). Still (unlike the former), when the latter is administered to a man, it is found to have a purgative action. This difference is due to *prabhava*. Similarly,

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64. *Ibid*. ii. 364.

when poison itself is found to counteract the effects of poison, the real cause is to be viewed as *prabhava*. Again, whether a substance should act on the morbidity in the upper part of the body or in the lower part of the body, is determined by its *prabhava*. (i.26.67-69)

But what exactly is meant by *prabhava*? The *Caraka-samhita* comes out with the frank admission that at the stage of knowledge represented by it, *prabhava* is something beyond the comprehension of the doctors : *prabhabah acintyah ucyate* (i.26.70). To this may be added what the *Susruta-samhita* says : "Why should certain drugs have by nature specific efficacies can neither be settled by arguments nor fully explained. Hence the wise physician should prescribe those according to the medical wisdom recorded in the authoritative works." (i.40.22)

Thus, with all the gropings for the understanding of the nature of substances and of their actions on our bodies—gropings, in other words, for the knowledge of the interaction between environmental matter and body-matter—the ancient physicians feel in their own way that they can comprehend it only up to a certain stage, and not beyond that. There remain unsolved problems about the way in which the natural substances affect our bodies and it is unwise for the early scientists to offer any definite theory about it.

33. KNOWLEDGE AND POWER

It is evident from what is already discussed that all aspects of Ayurvedic theory do not have for us the same interest. The view, for example, that all diseases are due to the three waste-products of food—*vayu*, *pitta* and *kapha*—is not of abiding significance for the history of science. But the realization that science-consciounsness demands an affiliation to the materialist view continues to have significance even for our times. We shall note here a few more features of Ayurvedic theories connected with the latter.

In the passage of the *Susruta-samhita* last quoted, it is admitted that the efficacy of certain drugs cannot be determined by arguments, nor can it be fully comprehended at the stage of medical research represanted by the text. At the same time, it is emphasized that there is nothing about the phenomenon to make the doctor submit to any supernatural view of things. Such an efficacy belongs to the drug because of its inherent nature : *parsiddhani* *svabhavatah.* What exactly does this mean ? Elsewhere the text gives a very clear answer to this : "The understanding of certain substances as heavy and of others as light must be considered as being determined by nothing but their inherent nature or *svabhava.*" (i.46.448)

Here is the typical example with which this is illustrated. The flesh of aquatic and wet-land animals is heavy while that of the *jangala* animals is light. Why is this difference between the two ? For the ancient physicians, there is ultimately only one answer to this. The difference is due to their inherent nature or *svabhava.* Put in modern way, this means that the difference is due to the laws of nature.

In this connection, the *Susruta-samhita* wants to go into greater detail of the problem. It discusses how, when a substance is qualitatively changed, it acquires altered *svabhava.* Thus, for example, though the *vrihi* rice is by nature heavy, when baked in heated sand and transformed into puffed paddy the latter becomes by nature light.[65] But let us not go here into the complicated details of all these. Let us concentrate instead on the more basic point, namely that of the importance of the view of the law of nature or *svabhava* for Ayurveda. The *Caraka-samhita* gives us many glimpses of this. Certain substances—call these drugs or diets—are observed to have certain specific actions on our bodies. The ultimate explanation of this is to be sought in the view of *svabhava* or law of nature. As the text puts it :

> It is only because of *svabhava* that water moistens, salt liquefies, alkali digests, honey synthesises, ghee adds to unctuousness, milk promotes vitality, flesh adds to strength, flesh-broth nourishes, alcohol inebriates, *sidhu* wine emaciates, grape wine stimulates digestion, liquid molasses cause accumulation of morbid matter, curd produces eodema, the *pinyaka* plant causes depression. (i.27.4)

For a better understanding of the view of *svabhava* in the Ayurvedic theory we may turn to certain passages of the *Caraka-samhita.* When we do this we can clearly see that the view of *svabhava* or laws of nature goes to the formation of the very concept of Ayurveda and that moreover in trying to develop such an understanding of Ayurveda the ancient physicians seem to anticipate the modern idea that knowledge is power. It may be convenient for us to begin with the latter point, a few words on which serve to introduce the way in which the ancient doctors propose to understand their science.

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[65] See Devendranatha and Upendranatha Sengupta (Bengali tr.) 261.

As we have repeatedly seen, the physician's knowledge consists mainly of all sorts of material things or natural substances and of their actions on human body—the knowledge on which depends his therapeutic technique of adjusting the interaction between environmental matter and body-matter. But the physicians are anxious to explain that this technique is not to be misunderstood. The interaction between environmental matter and body-matter takes place according to the laws of nature, and, as laws of nature, these are immutable. The physicians cannot tamper with these laws in any way. They can neither create these laws nor alter their course of action. All that they can do is to acquire better insight into these laws, so that their natural course is best utilized in the interest of the patient, i.e. to ensure his health or cure his diseases. This is easily explained with the analogy of fire. Fire burns or radiates heat, and this because of the laws of of nature. There is no way of changing the law itself. But there are ways of using the knowledge of this law to serve our purposes —inclusive of medical purposes, as for example, in cauterization and cooking, two of the most useful techniques from the standpoint of ancient Indian medicine.

Thus, all the mastery over nature that the doctor can aspire after is conceived in terms of the knowledge of nature. If anywhere in ancient Indian thought we are permitted to see the real anticipation of the view that knowledge is power—which, when further worked out, assumes the formulation that freedom is the recognition of necessity—it is to be found among the practitioners of the healing art. But it is not easy for the ancient scientists to develop expressions adequate for conveying such a profound view. Here is one of the ways in which they grope for such expressions :

> Like poison, like weapon, like fire, like lightning—the drug whose nature is not understood remains a source of unknown terror. When understood, however, it proves as beneficial as nectar. (i.1.24)

This is an ancient way of putting the point no doubt. But the point itself is not primitive. Fire, poison, etc. are for us sources of disaster only so long as their real nature remains not understood. But as we acquire insight into these, we can use these for our great benefit. So also is the case of the drugs. Knowledge is power.

Elsewhere in the *Caraka-samhita* basically the same idea is expressed in a way which may at first appear to be quite peculiar. We have to re-read it to see its real implication. It is argued that Ayurveda—in the sense of a body of natural laws—is beginningless or *anadi* because nature exists from a beginningless past and, along with nature, the laws that are inherent in it. Medical science can be said to have a beginning only from the standpoint of acquiring the knowledge of these laws or of spreading the knowledge. So also it is necessary not to misunderstand the meaning of the therapeutic technique. Diseases are cured not by any artificial technique of which the doctors are the inventors. These are cured by the laws inherent in nature which the doctors can only know and rightly apply. Here is how the *Caraka-samhita* tries to express all this :

"Ayurveda is called eternal, because it is without beginning, because it is nothing but the laws inherent in nature (*svabhava-samsiddha-laksanat*) and because the natural properties of the real substances are unalterable (*bhava-svabhava-nityatvat*). There had never been any break in the continuous stream of life, nor in the continuous stream of knowledge. Living beings are always there. Pleasure and pain—along with the substances causing these—are beginningless, because so are their interdependent relations. The subject-matter of medical science is this : body-materials that are heavy or light, cold or hot, unctuous or dry, etc. increase or decrease by the repeated use of like and unlike substances respectively. Thus, that which is heavy in the body increases and that which is light in the body decreases by the continued consumption of substances that are heavy, and conversely (that which is light in the body increases and that which is heavy decreases by the repeated consumption of light substances). Such inherent nature of substances is beginningless, as is the inherent nature of matter in earth-form etc. But the substances themselves and their properties may or may not be permanent :

Apart from the restricted sense of acquiring this knowledge and of spreading it, there is no meaning in saying that medical science came into being having been non-existent before. It is indeed only with reference to these two circumstances (i.e. of acquiring the knowledge of the laws of nature and of spreading such knowledge), that the origin of Ayurveda is alluded to by some. But there is nothing about these laws (and therefore about medical science, which is only a body of these laws) that is created by anybody (*akrtaka*). As is said in the present chapter as well as in the first chapter, these laws are but the laws of nature (*svabhavika*)—just like the laws because of which fire is hot and water liquid. (i.30.27)

The point mentioned last needs to be very carefully noted : *svabhavikam ca asya laksanam akrtakam yat uktam iha adye adhyaye ca ; yatha agneh ausnam apam dravatvam.* From the need felt to repeat the same point already stated earlier, the importance intended to be attached to it is obvious. The view of the laws inherent in nature—technically known as *svabhava* in Indian philosophy—is an essential postulate of medical science. It is specially emphasized in the passage just quoted that, without the assumption of such immutable laws, what is considered as the main point of the therapeutic technique by the ancient doctors remains inexplicable. It is because of such laws that the excessive absorption or lack of absorption of an environmental matter by man results in the excess or diminution in him of body-matter in some form. And disease means nothing but this. It is because of these laws of nature, again, that the absorption of counter-matter by body-matter results in the restoration of the balance of body-matter, which, in other words, means cure. These laws of nature are inviolable—as inviolable as those because of which fire is hot and water liquid. There is no way of changing these laws. Still the physician can and does intervene. He cures sickness and helps people to maintain good health. But he does this not on the strength of any artificial technique invented by him for the purpose of flouting these laws of nature. What is possible for him is to know these laws and thereby to make the best use of these in the cause of the patient. Since these laws are beginningless and since medical science is nothing but the knowledge of these laws, it is impermissible to imagine that medical science came into being at some particular time, having been non-existent before. Only from the viewpoint of knowing these laws and of propagating their knowledge can one speak of the origin of medical science.

Thus the fundamental postulates of Ayurveda are : (1) everything in nature takes place according to the laws inherent in nature, (2) though immutable, these laws are nevertheless knowable, and (3) the knowledge of these laws brings power over nature, which, medically speaking, means ensuring long life. Only with these points in mind, we can see the real significance of the basic understanding of Ayurveda given in the *Caraka-samhita*. As a preliminary definition of the science, the text says :

> That is called Ayurveda in which is explained and proved what is good and what is bad for life, what is pleasant and what is painful for life, what is wholesome and what is unwholesome for life. (i.1.41)

But the question is : How can the physicians hope to prove and explain what is good etc. for life ? There is only one answer to it. They have to study the inherent nature of different substances and the laws according to which these act on our bodies. Hence the *Caraka-samhita* adds :

> It is called Ayurveda, because it gives knowledge of long life. But how does it give this knowledge ? The answer is as follows : It is called Ayurveda because—depending on definite proofs and disproofs—it gives us the knowledge of substances, their qualities and actions, as they are by their inherent nature and (by this inherent nature) cause pleasure or pain, prove wholesome or unwholesome, promote or adversely affect long life. (i.30.23)

All these make sense only when it is assumed that there are definite laws according to which the natural substances affect our bodies, that these laws are knowable—i.e., in the Ayurvedic terminology, are subject to definite proofs and disproofs—and that therapeutic success essentially depends on these laws.

We have discussed all these mainly to emphasize one point. The view of *svabhava* is essential for Ayurveda. Why should a natural substance with its specific matter-composition affect the matter-composition in our bodies in a specific way is, in the physician's view, determined only by the laws of nature or *svabhava*. The commitment to the view of *svabhava* is indispensable for Ayurveda. But it is also a risky commitment because Indian orthodoxy considers it as characteristic of the materialists, and hence as something highly heretical.

What then are the physicians to do if the general theoretical requirements of their science necessitate the acceptance of the view of *svabhava*? From the extant *Caraka-samhita* it appears that at least some of the early theoreticians of medicine boldly face the risk. Thus, apart from some of the passages of this medical compilation we have already quoted showing clear acceptance of the view, the earliest theoretician of Ayurveda mentioned as Bharadvaja remains a staunch defender of it. But the later editors or reconstructors of the work apparently hesitate. To evade the censorship of the law-givers they not only make a show of converting Bharadvaja to a follower of orthodoxy but also graft on the text long discourses ennobling the view of *karma* and rebirth, going so far as to be reckless to the internal consistency of the medical work. But notwithstanding all the later grafts of orthodox religious views on the text, its later reconstructors do not go to the fanatical extent of destroying or obliterating the theoretical positions once achieved by Indian medicine. This gives the extant *Caraka-samhita* a peculiar appearance. The metaphysical and religious views introduced into it presumably by its later reconstructors—inclusive of the views of *karma* and *adrsta*—remain on the whole loosely superimposed on its genuinely scientific content.

34. DEFENCE OF MEDICINE

An entire chapter of the *Caraka-samhita* is in defence of the intrinsic efficacy of medical science. It is reminiscent of a brief tract surviving in the Hippocratic collection with the title *The Art*, which has ostensibly the same theme. Besides, some of the objections raised and answered against the possible efficacy of medicine in both are at least apparently similar. But the similarity ends there. What is of greater importance is that which distinguishes the *Caraka-samhita* from *The Art*.

Specially in the context of the general ideological situation of ancient India, the defence of the instrinsic efficacy of medicine in the *Caraka-samhita* cannot but have a very radical implication. It amounts to the rejection of the law of *karma*, if not in so many words at least by clear implication. The risk involved in this is obvious. *Karma* provided the ideological justification of the hierarchical society, to question the law of *karma* is one of the surest ways of being viciously attacked by the law-givers. But the ancient doctors of India apparently feel that it is not an avoidable risk. As practising physicians they have to defend their own knowledge and their own technique, notwithstanding the law-givers.

In this chapter of the *Caraka-samhita*, in other words, we have the impression of how science is obliged to come in open confrontation with the vested interests in society. But *The Art* gives us no impression of such a confrontation. One important reason for this is that *The Art* is not at all the product of an active scientist keen on defending the knowledge and technique he stands for. It is on the contrary written by some leisured elite seeking delight in sophistry and rhetoric. His choice of the subject-matter for the purpose—viz. medical science—is on the whole an arbitrary one, because he hardly gives us the impression of having any sound and first-hand knowledge of this science itself. As W.H.S. Jones, introducing his translation of *The Art*, remarks:

"It is quite plain from even a cursory reading of the treatise that its author was not a physician. His interest lies in subtle reasonings and in literary style, not in science. Besides this, in the last chapter he speaks of 'those who are skilled in the art' as giving a proof of the existence of medicine based on works, and not, like the proofs given in the present book, on words. He evidently distinguishes himself from medical men. The two most striking characteristics of *The Art* are an attenuated logic and a fondness for sophistic rhetoric. The rhetorical character of the whole book is so striking that without doubt it must be attributed to a sophist. The elaborate parallels, verbal antitheses, and balancing of phrase with phrase, can have no other explanation."[66]

But the defence of medicine in the *Carka-samhita* is quite different. Those who are defending it give us the unmistakable impression of being practising physicians, for whom the intrinsic efficacy of their knowledge and technique is far too important a proposition to allow them secking delight in the subtleties of sophistry, rhetoric and literary style. The main question with which they are confronted is : How far, from the medical viewpoint, is it valid to claim that the disciplined knowledge of nature enables man to master it ? In the Indian context, at any rate, this is the basic question of science *versus* counter-ideology, for the latter demands of man the submission to unquestioning faith in some supernatural or "unseen" power controlling his destiny—his birth and death, his pleasures and pains, his health and disease.

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[66] W.H.S. Jones *Hippocrates* ii. 186-87.

Before passing on to see all these, let us sum up the defence of medicine in the *Caraka-samhita.*

In the Ayurvedic view, successful medical treatment depends on four factors. These are : the physician, substances (drugs or diets), nurse and patient. Accordingly, a chapter of the *Caraka-samhita* is designed to explain these four factors, or more properly, the desirable qualities or qualifications of each of these four, the combined operation of which leads to therapeutic success. The text mentions in this connection four such qualities of each of these four factors. We quote these not only to see how remarkably free the medical view is from supernaturalism and scriptural cant but moreover because some of the things said by the ancient doctors retain profound significance even for our times.

The four essential qualifications of the physician are :

(1) clear grasp of the theoretical content of the science, (2) a wide range of experience, (3) practical skill, and (4) cleanliness.

The four essential qualities of the drugs or substances are :

(1) abundance, (2) applicability, (3) multiple use (or, what is perhaps called "broad spectrum" in modern medical jargon), and (4) richness in efficacy.

The four essential qualifications of the nursing attendant are :

(1) knowledge of nursing technique, (2) practical skill, (3) attachment for the patient, and (4) cleanliness.

The four essential qualifications of the patient are :

(1) good memory, (2) obedience to the instructions (of the doctor), (3) courage, and (4) ability to describe the symptoms. (i.9.6-9)

Something is so striking about this enumeration of the qualities of the "four factors" ensuring medical success that it is impossible for us to overlook it. While enumerating the desirable qualities of the patient, the medical compilation is absolutely silent about the accumulated merits of his past actions contributing to his recovery. In other words, it is totally silent about *karma* and *adrsta*. How are we to account for this silence ? Could it be that the ancient physicians were unaware of the importance attached to this view in the officially boosted world-outlook of ancient India ? It is obviously impossible to take such a possibility seriously. Could it then be that the doctors believed in *karma* and yet forgot to mention it in this context ? This again is inconceivable, because the discussion of the merits of the patient is about the surest context of mentioning the *adrsta* of the patient on the part of those who believed in it. The silence of the *Caraka-samhita* about *karma* and *adrsta* of the patient, even in this context of discussing the qualities essential for his recovery, can thus have only one significance for us. From the medical viewpoint, *karma* is considered a redundant hypothesis. So the physicians prefer to ignore it altogether. They have far more serious things to discuss instead, namely the real merits of the patient really contributing to his recovery. These are good memory, obedience to the doctors, fearlessness and the ability to communicate the exact nature of his troubles. A doctor today has perhaps little to add to the ancient doctors on the basic desirability of these qualities in the patient. But the situation in which he is placed is quite different. A great deal of political courage is not required today to say all these. But this political courage is required of the ancient doctors, because they live in a world in which the law-givers declare that any indifference to the law of *karma*—which this assertion obviously entials—is nothing short of heresy. The ancient Indian doctors, however, cannot help this. Their science and the law of *karma* do not go together. This becomes all the more obvious when they defend the intrinsic efficacy of medical science. The defence of medicine in the *Caraka-samhita* is thus much more than a matter of mere intellectual exercise, which it largely is in the Hippocratic tract called *The Art*.

The discussion of the four basic factors on which medicine depends and of the four marks of excellence of each of these, forms the theme of the ninth chapter of the Sutra-sthana of the *Caraka-samhita*. In the next chapter of the work is taken up the question of the intrinsic efficacy of medicine. The discussion is introduced as follows :

The chapter opens with the declaration that the rational application of medicine depending on these four factors characterized by their sixteen marks of excellence are sure to lead to the cure of a curable disease (i.10.3). But there is a *prima facie* objection against such a claim. The fact is that in spite of receiving medical treatment characterized by these four factors a patient is often found to die, just as a patient is often found to be cured in spite of the absence of these four factors. Thus it is impermissible to claim that medical treatment characterized by these four factors causes the cure of diseases. The actual role of medical treatment in the cure of the patient is at best an extremely negligible one. As a certain Maitreya—about whom the medical compilation tells us hardly anything more—expresses this objection in the *Caraka-samhita* :

> Maitreya said : No, this is not so. Why ? It is observed no doubt that a patient for whom the medical substances are available, who is attended by the nurse and who is possessed of all these qualities—when treated by an expert doctor—gets cured. But it is also observed that another patient —in spite of the presence of all these in his case—is led to death. Medical treatment is thus of no real significance. It is like dropping just a little water into a well, a lake or a river, or like scattering a handful of dust on a sand dune.
>
> It is also observed that a patient without the supply of drugs, unattended by a nurse, lacking in the personal qualities and treated by an unqualified doctor gets cured, while others—similarly circumstanced—die all the same.
>
> Thus medical treatment is followed by recovery as well as death. Also, the want of medical treatment is followed by recovery as well as death. Therefore, medical treatment is of no more consequence than the absence of it. (i.10.4)

Let us first note that in the ancient Indian context there is a special risk for the scientists in raising this discussion. The risk is that while answering the objection raised they have either to acquiesce to an ideology opposed to science or to come in open confrontation with the ideological requirements of the vested interests. The way in which Maitreya is made to raise the objection in the *Caraka-samhita* is not perhaps without a hint of such ideological requirements inspiring the objection. From the observed cases of recovery as well as death resulting from both the presence and absence of medical treatment, he does not argue that both recovery and death are just fortuitous or without any cause whatsoever. The main drift of his arguments is that there is something infinitely more important than medical care which determines recovery as much as death. Compared to it, medical treatment is as insignficant a factor as a few drops of water for a lake or handful of dust for a sand-hill. What then is this something supposed to be determining both recovery and death? Though in the present context our *Caraka-samhita* does not specify it in so many words, from what is known in general about the ideological climate of the country it may not be impermissible to presume what the objector has in mind. There is a theory widely circulated in ancient India with the powerful backing of the priests and law-givers according to which both recovery and death are being determined by some omnipotent law other than the one the physicians speak of. That is the law of *karma*. When therefore our Maitreya speaks of something vastly more important which really determines recovery as well as death—something compared to which medical science is supposed to be insignificant —the possibility of his having the law of *karma* in mind cannot be easily rejected.

All this, it will perhaps be argued, is more or less conjectural. What is not at all conjectural, however, is another point. While answering the objection raised against the efficacy of medical science, the physicians do in fact completely ignore the law of *karma*. They seem to brush aside the officially boosted view that life and death, health and disease—in fact all that a man enjoys or suffers—are being determined by the "unseen" hangovers of actions performed by him in his past life. They argue, on the contrary, that the knowledge and technique which they represent have by themselves the efficacy of ensuring long life or of effecting actual cure.

Not that they make the absurd claim that they can cure all diseases. Like the modern doctors, the ancient doctors are also aware of the fact that medicine notwithstanding, certain diseases remain incurable, though of course the range of incurable diseases for them is much wider than it is for the modern doctors. But they very strongly assert that a right doctor rightly applying the therapeutic technique can never fail to cure a curable disease. But what about the objection supposed to be based on actual observation that some patients die in spite of it? From the physician's point of view, such an objection is based at best on pseudo-observation or inadequate observation. It is not enough to observe whether a patient gets cured by medical treatment or not. It is essential to note moreover the nature of the disease he suffers from. If the disease is incurable by nature, the patient dies in spite of full medical care, or according to the Ayurvedic way of putting it, in spite of all the four factors of medicine along with their sixteen qualities being present. But this cannot be true when the disease is a curable one. As the *Caraka-samhita* puts it :

> It is wrong to claim that in spite of the presence of medical treatment with the sixteen desirable qualities (of the four factors of medicine) some patients are observed to die. In cases of diseases amenable to medical treatment, medicine can never be ineffective. (i.10.5)

This is illustrated with the analogy of a good archer :

> As a bowman who is a good marksman and given to constant practice, taking up a bow and releasing an arrow does not fail in hitting a big target that is not far off, and achieves his purpose, so does a physician of accomplishment and means who starts treating a curable disease after full investigation, without fail bestow health on the patient. Hence it cannot be said that treatment is no better than no-treatment. (i.10.5)

We hear in this the unmistakable voice of a confident scientist sure of the efficacy of his knowledge and technique. The right physician rightly treating his patient cannot but cure his curable disease. We shall presently see how the *Caraka-samhita* explains the actual basis of this self-confidence and what moreover it means by curable disease. But it needs at once to be noted that the assertion just quoted leaves no scope either for the view of *adrsta* or that of chance or luck in the physicians' defence of the efficacy of medicine.

In the Hippocratic tract called *The Art*, there is naturally no question of compromising with the theory of *adrsta*, which is peculiarly important in the Indian context. However, being the product of an amateur rather than a practising doctor, the work does not eliminate the possibility of luck or chance coexisting with real medical efficacy. Here is how the tract answers a similar objection :

> The beginning of my discourse is a point which will be conceded by all. It is conceded that of those treated by medicine some are healed. But because not all are healed the art is blamed, and those who malign it, because there are some who succumb to diseases, assert that those who escape do so through luck and not through the art. Now I too, do not

> rob luck of any of its prerogatives, but I am nevertheless of opinion that when diseases are badly treated ill-luck generally follows, and good luck when they are treated well.[67]

The cleverness of the literary style of this is not to be denied. But the answer to the objection against medicine given here is based on the same fallacy of observation on which the objection itself is based. From the standpoint of the *Caraka-samhita*, it is the generalized view of patients and their diseases, without going into the medically important question of the specific nature of the disease a particular patient is suffering from. Once this erroneous view of patients and diseases is conceded, the author of *The Art* cannot possibly reject the element of luck, because he cannot escape the fact of pseudo-observation that some patients get cured while others do not in spite of the same medical treatment. When, however, the specific nature of the disease is taken into account —as the *Caraka-samhita* does—the intrinsic efficacy of medicine need not be defended by saying that good luck usually follows good treatment and ill-luck generally follows bad treatment. One reason why the author of *The Art* fails to assert that the specific nature of the disease needs to be noted is that he is not a practising doctor, though what makes it also easy for him to make room for the element of luck in the actual cure of the patient is the thinness of the therapeutic technique itself of the times of which *The Art* is the product : "in the Hippocratic age little could be done for patients suffering from acute diseases except to keep them warm and comfortable, and to restrict their diet."[68]

The physicians of the *Caraka-samhita* feel differently. They feel that the vast empirical data before them help them to develop insight into certain laws of nature which, rightly followed, enable the doctors to cure the curable diseases without fail. Thus immediately after explaining the infallibility of the qualified doctor's technique on the analogy of the trained archer, the *Caraka-samhita* explains that this is not to be misunderstood as empty bragging. What makes the medical technique infallible is that it is based on some well-defined principles justified by empirical data :

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67. *Ibid.* ii. 195.
68. *Ibid.* ii. Intro. viii.

> We follow the following principles because all these are well-established by our direct observations : We cure the sick by sickness-removing drugs, the emaciated persons with emaciation-removing agents. We cure the thin and sick persons with nourishment, just as we prescribe restrictions of food for the flabby and fatty ones. We treat with 'cold' those who are afficited with 'hot' and with 'hot' those who are afficted with 'cold'.
>
> When some body-element becomes diminished we prescribe for its increment, just as when some body-element becomes excessive we prescribe for its diminution. (i.10.6)

Thus enumerating the empirically justified basic principles of medicine, the *Caraka-samhita* quotes an authoritative verse reiterating the self-confidence of the skilled physician :

> A physician who knows how to differentiate between the curable and incurable diseases and who, with proper medical knowledge, begins the treatment of the patient in time, is absolutely certain of attaining success. (i.10.7)

Lest this emphasis on the absolute certainty of the physicians' knowledge and technique gives us the wrong impression that by "curable diseases" they mean only certain minor ailments, the *Caraka-samhita* wants to be quite clear about these :

> The curable diseases are of two kinds : those that are easily cured and those that are cured with difficulty. The curable ones are, alternately, classed in three main categories by reason of their requiring mild, moderate or strong treatment.
>
> The characteristics of an easily curable disease are : the causes, premonitory symptoms and symptoms are mild ; the morbific factor is homologous neither to the affected body-element nor to the habitat of the patient, nor to the traits of the prevailing seasons ; the location of disease is not inaccessible to treatment ; the course of disease is localised in one system, is recent, has no complication and is due to the predominance of one *dosa* (i.e. due to the excess or diminution of only one of the three waste products of food like *vayu, pitta* and *kapha*); the body is in a condition to withstand all treatment and the fourfold requisites of treatment are at hand. These are the circumstances in which a disease is easily curable.
>
> The diseases cured with difficulty are : those wherein the causes, the premonitory symptoms and symptoms are of moderate strength : when any one of the three—the season, the habitat and the susceptibility of body-elements—is homologous with the morbific factor ; the diseases of a woman in pregnancy or of a man of old age or of an infant though not very seriously aggravated by complications ; those that require surgical operation, caustic and cauterizing procedures ; those whose diseases have

> gone beyond the incipient stage ; those whose diseases are located in some part of the body to which access is difficult ; those for whom the four factors of treatment are not fully available ; those whose diseases have spread to more than one system but have not yet become very chronic and those whose disturbance is due to two *dosa*-s. (i.10.9-16)

When therefore the physicians declare that the curable diseases can be cured by them with certainty they do not have an over-simplified view of such diseases. They are fully aware that some of these are extremely difficult to cure. Still they feel convinced that granted all the four factors of medicine with their sixteen qualities, they cannot but succeed in curing such diseases. The medical technique is infallible even in such difficult but curable cases.

But what about the incurable disease ? The *Caraka-samhita* says, "The incurable diseases also fall into two categories : those that respond to palliatives and those that are not even so." (i.10.9)

The need is accordingly felt to explain the nature of these two types of incurable diseases. So the *Caraka-samhita* continues :

> The diseases of the following description are to be regarded as incurable but responding to palliatives : those in which the patient, being left with some hope of living a little longer, may be given some relief with strict regimen etc., but the diseases get easily aggravated by slight causes, because the diseases are very deep-seated, affect many body-elements, are located in vital parts and joints, are liable to constant relapse, have become very chronic and are caused by two *dosa*-s. The following diseases are incurable and the physicians can do nothing about these : over and above having the marks just mentioned, diseases that are due to the complete disturbance of all the three *dosa*-s ; those that affect all the systems of the body and hence are totally beyond the range of any treatment ; those that cause great excitement, restlessness, stupefaction and destruction of all sense-faculties ; those, that get greatly aggravated by afflicting weakened constitution and those that are accompanied by fatal prognostic signs. (i.10.17-20)

All this gives us some idea of the limits of therapeutic power as understood by the *Caraka-samhita*. Since this is ancient medicine after all, we do not perhaps expect more from it. However, precisely because it is ancient Indian medicine, something really remarkable about this discussion is not to be overlooked. It is the claim that even in some cases of incurable diseases, the doctors can prescribe effective palliatives, and thereby relieve the patients of the inevitability of suffering caused by the diseases. Is this not another way of disowning the law of *karma*, according to which—like the disease itself—the suffering caused by it is completely determined by the evil actions performed in the past?

It remains for us to discuss another point in this connection. The objection raised against the intrinsic efficacy of medicine is based on two main grounds. First, patients are observed to die in spite of receiving full medical treatment, secondly, patients are found to recover even without any medical treatment. We have seen how, in refutation of the first ground, the *Caraka-samhita* insists on determining the nature of the disease. But what about the second of the objection? The text says:

> And, again, as regards those who recover without the aid of the treatment—even in their case there is a special reason for giving them a complete course of treatment. Just as a man, by lifting another who has fallen—although the latter is able to rise by himself—gives him support, in consequence of which he rises sooner and without difficulty; in like manner do patients receiving the aid of a complete treatment recover more easily and without difficulty. (i. 10.5)

Thus the ancient doctors do not deny the natural power of the organism helping it to get cured of certain diseases, though their actual knowledge of this natural endowment of the body—compared to that of the modern doctors—is understandably negligible. But the point they want to argue remains valid today. This cannot be an evidence against the instrinsic efficacy of medicine, because medicine ensures quicker and surer recovery even for those that may eventually get cured by the natural endowment of the body.

Let us compare this with the answer to a similar objection given in the Hippocratic tract called *The Art*. "Now", its author says, "my opponent will object that in the past many, even without calling in a physician, have been cured of their sickness, and I agree that he is right. But I hold that it is possible to profit by the art of medicine even without calling in a physician, not indeed so as to know what is correct medical treatment and what is incorrect, but so as by chance to employ in self-treatment the same means as would have been employed had a physician actually been called in.... For even those who, without calling in a physician, recovered from a sickness must perforce know that their recovery was due to doing something or to not doing something."[69]

This, to say the least, is a very strange defence of medical science from the standpoint of the working doctors. People may "by chance employ in self-treatment the same means as would have been employed had a physician actually been called in" and thus "perforce know that their recovery was due to doing something or to not doing something." Does this mean that sometimes by pure accident people may stumble upon the knowledge and technique which make one a physician ? If so, medicine as a discipline consciously striving after the knowledge of the causes of disease and of its cure becomes largely redundant. In the hand of the sophist, thus, the defence of medicine easily passes into its opposite.

From the viewpoint of the *Caraka-samhita* at any rate, such a defence of the efficacy of medicine in inconceivable. We have already seen that while talking of the actions of the different substances on our bodies, it takes special care to add the expression *pramanatah-apramanatah*—"based on definite proofs or disproofs." (i.30.23)

Those who defend the healing art in this medical compilation are interested above all in the cure of the patient no doubt. But they are also fully aware that their healing technique is raised to the level of genuine science only when its rationale is adequately understood. This leads us to see another important aspect of rational medicine defended by the *Caraka-samhita*, namely, an elaborate epistemology developed from its methodology.

35. SCIENTIFIC METHOD AND EPISTEMOLOGY

The *Caraka-samhita* says, "Any success attained without reasoning (*tarka*) is as good as sheer accidental success": *vina tarkena ya siddhih yadrccha-siddhih eva sa*. (viii.2.28)

The *Katha Upanisad* declares, "Not by reasoning (*tarka*) is this wisdom (*mati*) to be attained": *na esa tarkena matih apaneya*. (ii.9)

Manu advises, "Greet not even by words one who is a logician": *haitukam . . . vak-matrena api na arcayet*. (iv.30)

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[69] *Ibid*. ii. 197.

We have here three clear policy statements on rationalism and logic. The physicians find their therapeutic technique useless if it is not based on reason. The metaphysicians of the *Upanisad*-s, striving after some supra-rational wisdom of the pure self, express disapproval of the rational approach. The law-giver, convinced of the political utility of implict faith in the scriptures, detests the logician or rationalist. There is thus something that unites the metaphysician with the law-giver.

It is the negative attitude to rationalism or logic, though, while the law-giver simply decrees it, the metaphysician has to seek philosophical grounds justifying his damnation of reasoning. This becomes clearer in the case of the most influential of the later champions of the Upanisadic metaphysics, the Advaita Vedantists. Samkara, for example, tries to prove at some length why *tarka* or reasoning cannot have an efficacy of its own ; the only efficacy that it possibly has is to rationalize what is already revealed in the scriptures.[70]

This, he realizes, necessitates the rejection of the very possibility of any valid system of logic and epistemology. Hence he opens his philosophical *magnum opus* with the claim that what are ordinarily called *pramana*-s or "instruments of valid knowledge"—specially experience and reason—operate only within the general framework of ignorance or *avidya*. Sriharsa, a later follower of Samkara, shows the most imposing scholastic skill in refuting the *pramana*-s.

Thus, in short, the idealist outlook of the *Upanisad*-s, though with the most powerful financial and political support behind it, leads ultimately to the total eclipse of logic and epistemology. The humble researches of the physicians in man and nature have a different destiny. They find that the commitment to rationalism is essential for their researches, on which depends their therapeutic success. This, as we shall see, leads them to bequeath to Indian thought the fundamentals of a sound system of logic and epistemology.

But let us first try to be clear about the general need felt for rationalism by the practitioners of the ancient healing technique.

The maxim we have just quoted from the *Caraka-samhita* occurs in a chapter added to it by Drdhabala, its final "reconstructor". But there is no doubt that the maxim itself is true to the actual spirit of the ancient doctors. The medicine they stand for is characteristically rational. An important reason for this is their basic commitment to the causal law. The *Caraka-samhita* allows the possibility of the doctors belonging to different schools to differ from each other on various medical matters. Each school of medicine is entitled to have certain conclusions characteristic of itself. What the physicians do not allow, however, is the possibility of any serious school of medicine remaining indifferent to the principle of causality. The causal principle is one of the three fundamental propositions absolutely binding on all schools of medicine. How can one be a serious doctor without being convinced that there must be a specific cause of a disease, and also of its cure ? But any non-rational way of knowing the cause is inconceivable. Hence rationalism is obligatory for all physicians.

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[70] Samkara on *Brahma-sutra* ii. 1. 11.

There is no doubt that even without a rational understanding of the actual cause of cure, somebody may stumble as it were on some curative procedure. Cases like these are ordinarily called cases of accidental success or success due to mere chance—*yadrccha-siddhi*. From the medical viewpoint, such a success is accidental not in the sense of having no cause but in the sense of unknowingly hitting upon some cause which turns out to be the real cause of cure. In other words, there may sometimes be a right way of doing something, though without at all knowing why this—rather than any other—is actually the right way of doing it. The Indian doctors feel that something like this accounts for the occasional success of the medical quacks or charlatans. It is success without any rational insight into the cause of the success, i.e. without the awareness why only one specific course of treatment rather than any other leads to the actual cure of disease. The occasional success of the quack—because it is not rationally understood—creates special danger for the patients in general. It gives him a false sense of self-confidence, with which he tries his random technique on many others and thereby brings disaster to them. Describing the quack, the *Caraka-samhita* draws our attention to the danger created specially by his occasional success :

> Like a man without eyes or like a canoe left at the mercy of winds, the ignorant physician gropes about timidly because of his lack of knowledge. However, when he meets accidental success in the case of some otherwise assured of life (*niyatayusa*), the pretentious quack gathers courage with

which he hastens the death of many others whose lives are not thus assured (*a-niyatayusa*). (i.9.16-17)

From the viewpoint of the *Caraka-samhita*, the qualified physician creates no such risk for the patient, because his knowledge of what is conducive to life and what is not is based on definite proofs and disproofs (*pramanatah-apramanatah*) or because he possesses the "knowledge of cause and rational application" (i.2.36).

Hence is the maxim of the ancient doctors just quoted : Any success attained without reasoning is as good as sheer accidental success.

This leads us to see another aspect of ancient Indian medicine. We have seen before how much of importance is attached in it to the direct observation of man and nature. A very imposing amount of empirical data forms indeed the ultimate basis of Ayurveda. But the ancient doctors also feel that this by itself is not enough for their science. What it also requires is a rigorous discipline of reasoning. Only being processed by it mere empirical data can be raised to the status of scientific laws. The knowledge of these laws alone ensures therapeutic power.

Driven by their methodological requirements, therefore, the ancient doctors are led to develop very serious interest in the problems of experience and reason, i.e. in problems that are really epistemological. Understandably, the *Caraka-samhita* contains extensive discussions of epistemology. We propose to review this in some detail in the *Appendix* which is designed to discuss the question what Indian medicine possibly bequeaths to the general fund of Indian philosophical thought. We shall see there that it is not easy to dismiss Dasgupta's view[71] that such epistemological discussion of the physicians "was probably the origin of the logical speculations subsequently codified in the *Nyaya-sutra*-s." The plausibility of this becomes specially prominent when we remember that, of all the disciplines of ancient India, Ayurveda alone needed a serious system of logic and epistemology as part of its practical requirements. We shall note here only a few points to illustrate this.

As we have repeatedly said, the causal principle is abolutely essential for Ayurveda. None can be a qualified doctor unless he is clear about two points : what causes a disease and what causes its cure. The starting point of understanding the cause of both disease and cure is no doubt the observation of phenomena, for without this any view of the cause would be arbitrary, fanciful and purely speculative. But the ancient doctors also realize that it is impossible to establish the causal connection between two phenomena depending on perception alone. For this purpose, it is necessary to supplement perception (*pratyaksa*) by inference (*anumana*). This inference, again, is basically of two kinds : (i) from effect to cause and (ii) from cause to effect. Disease is an effect of certain factors, which constitute its cause. When therefore the doctors want to infer the factors causing the disease, they have to infer the cause from the effect. When, however, they prescribe certain drugs for the cure of the disease, they have to infer the effect from the cause : from the drugs, which constitute the cause, is inferred the cure, which constitutes the effect. But the doctors want to introduce a further distinction, depending on the time-context to which the cause and the effect belong. Thus, for example, when from the cause one infers the effect, one infers the future from the present : the drugs belong to the present and the cure belongs to the future. But when one infers the cause from the effect, the cause may belong either to the same time-context to which the effect belongs or it may belong to the past time-context. In other words, when one infers the cause from the effect, the cause may be co-existing with the effect (as for example, some form of matter-imbalance in the body causing some specific disease) or, compared to the effect, the cause may belong to the past (as for example, some faulty diet causing a disease).

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[71] S. N. Dasgupta ii. 273.

To sum up : (1) the inference must presuppose some previous perception, and (2) taking note of the time-contexts, it assumes three basic forms, viz. (a) from the present effect to the present cause, (b) from the present effect to the past cause, and (c) from the present cause to the future effect. Accordingly, the *Caraka-samhita* sums up its view of inference as follows :

> Depending on previous perception, one infers in three ways phenomena belonging to three time-contexts. Thus one infers the presence of fire from the smoke, though the fire itself remains unperceived. Similarly, the wise men know by inference the past, when for example they infer (past) copulation from the observation of the signs of pregnancy. Again,

> depending on the observation of the fruits growing from seeds, from the observation of the present seed they similarly know the future fruit.[72] (i.11.21-22)

But the physicians' problem is more complicated than inferring a simple cause from a simple effect or a simple effect from a simple cause. Their therapeutic problem is usually concerned with the conjunction of a number of causes leading to some specific effect. This follows from their understanding of medicine as dependent on "four factors": the cure of a curable disease is assured not by any of these factors in its isolation but by the right form of cooperation of all these four factors. Thus, in other words, though according to them the causal principle is absolutely essential for their science, their therapeutic technique depends on the knowledge of this causal principle in a much more complex form. Over and above *anumana*—which is adequate for knowing a simple cause from a simple effect or a simple effect from a simple cause—the physician wants to specify the nature of the intellectual discipline which more appropriately refers to the way of knowing such complex cases of causation. For this purpose, they introduce the concept of *yukti*, which usually means "rational application" but which, in the medical text, means the technique of determining how a number of factors jointly produce a specific effect. As the *Caraka-samhita* explains :

> *Yukti* or rational application means the way of knowing how from the conjuction of water, tilling, seed and season results the harvest, or how the foetal body results from the conjuction of the six *dhatu*-s (body constituents), or how from the conjunction of the flints, fire drill and the act of rightly striking it results fire. By the rational application of the four factors of medicine is thus effected cure. (i.11.23-24)

Thus the serious preoccupation with the causal principle does not allow the doctors to remain indifferent to the problems of logic and epistemology. But there is another aspect of their science-consciousness which draws them to discuss these problems in greater details. They realize that the knowledge gained by an individual physician under the guidance of an individual teacher, howsoever earnest both may be, is bound to have serious limitations. Hence it is necessary to evolve some technique to expand the horizon of his medical knowledge. This can be best done by intra-disciplinary discussion and debate, technically called *sambhasa*. So the *Caraka-samhita* advises, "A physician must enter into debate with another physician": *bhisak bhisaja saha sambhaseta* (iii.8.15). Explaining the desirability of it, the text adds :

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[72] cf. also Vatsyayana on *Nyaya-sutra* i. 1. 5.

> Debate with one belonging to the same discipline contributes to the perfection of one's knowledge and clarifies one's own understanding. It improves one's power of expression and thus adds to one's reputation. By creating scope for listening to what is already heard before, it dispels many doubts and confirms the truth of many a matter already learnt before, just as it enables one to know many things about which one had no previous opportunity of knowing. Sometimes a preceptor, pleased with the devoted services of a disciple, gradually imparts to the latter some aspect of medical knowledge otherwise kept secret by him (which the disciple too is supposed to keep secret). In the heat of debate, however, this care for secrecy is forgotten and, in the zeal of attaining victory in debate, the disciple comes out with these aspects of medical knowledge, thereby allowing his opponent to know it (which he would never have otherwise known). Those who are wise, therefore, strongly recommend intra-disciplinary debates." (*ibid.*)

Evidently the ancient physicians were putting this norm into actual practice, for the *Caraka-samhita* itself records for us the accounts of many debates among the physicians. But the general desirability of debates once felt does not allow the ancient doctors to remain indifferent to the rules and regulations to be followed in the course of the debate, i.e. to the right and wrong ways of arguing a case. This, it is presumed, formed the original core of the *Nyaya-sutra*, which contains for us the first systematic account of Indian logic, and is still largely concerned with the technique of debate. As Dasgupta argues, "The art of carrying on a dispute successfully was considered an important acquisition among medical practitioners. Thus we have a whole set of technical terms relating to disputes, such as are never found in any other literature, excepting the *Nyaya-sutra*. In the *Caraka-samhita* almost the whole of the chapter called Roga-bhisag-jitiya-vimana (iii.8) is devoted to this purpose. It is well to remember that different kinds of disputes and fallacies are mentioned in the *Nyaya-sutra*, and it will be useful to refer to these when dealing with similar topics from either the *Caraka-samhita* or the *Susruta-*

samhita".[73] But the original core of the discussion of the technique of debate and of the logico-epistemological questions connected with it seems to belong to Ayurveda. Thus, Dasgupta continues his argument, "Since we find no work of an earlier date, Hindu, Buddhist or Jaina, which treats of the logical subjects found in *Caraka-samhita,* and *since these logical discussions seem to be inextricably connected with medical descussions of diagnosis of diseases and the ascertainment of their causes*,"[74] it is only reasonable to think that all this originally develops among the medical practitioners. "The origin of the logical art of debate in the schools of Ayurveda is so natural, and the illustrations of the modes of dispute and the categories of the art of debate are so often taken from the medical field, that one has little reason to suspect that the logical portions of the *Caraka-samhita* were collected by Caraka from non-medical literature and grafted into his work."[75] The strong presumption, therefore, is that the medical schools give to Indian thought the first systematic effort towards logic and epistemology.

36. SCIENCE AND HUMANISM

To these outstanding features of ancient Indian medicine, we propose to add only another. It is the ideal of humanism that inspires the ancient scientists. Here is a passage of the *Caraka-samhita* which gives us a glimpse of this humanism :

> (Among the physicians) he surpasses all who practises medicine neither for the sake of money nor for the sake of sensual gratification in any other form, but is motivated only by the compassion for living beings.
>
> Those who, as a source of income, want to sell medical skill as any other commodity (*cikitsa-panya-vikraya*), appear to run after a heap of dust, overlooking the real hoard of gold.
>
> Compared to the physician who cuts off the noose of death and brings back to life those who are being dragged by fierce diseases towards death, nobody confers greater blessings—moral or material—to the human beings.
>
> One who practises the healing art with compassion for the living beings as the noblest of all duties is a person who really fulfils his mission and thereby gets entitled to the highest form of happiness. (vi. 1-iv. 58-62)

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[73] S. N. Dasgupta, ii. 377.

[74] *Ibid* ii. 399 (emphasis added).

[75] *Ibid.* ii. 402.

Here at any rate we read in ancient medicine something from which physicians today have surely much to learn.

We see in the ancient doctor the seeker of the knowledge of nature (*prakrtijna*), not only hoping to convert this knowledge into successful healing technique but also boldly protesting against the merchandization of his knowledge and skill, which is so aptly described as *cikitsa-panya-vikraya*. If, in view of the rudimentary technological development on which he historically depends, it is necessary for him to be patient in investigating nature, the way in which he chooses to be patient also in serving humanity—pinning his hope on the conviction that the knowledge of the laws of nature alone holds the prospect of alleviating human sufferings—cannot but be judged as highly remarkable. That is the image of the real scientist we have in the *Caraka-samhita*—"the composite image—devoted equally to the patient investigation of nature and the patient service of humanity", with scant respect for the idea that professional fee establishes the only bond between the healer and the healed. "To one who understands, knowledge of nature and love of humanity are not two things but one."[76] This indeed would be a very lucid way of putting what the genuine physician in the *Caraka-samhita* stands for.

37. SCIENCE AND PHILOSOPHY

While discussing the theoretical fundamentals of ancient Indian medicine we felt obliged to refer to the Vaisesika categories on the one hand and the Nyaya epistemology on the other. In view of the fact that certain palpable fables apart, we do not really have any dependable account of the origin of the Vaisesika and Nyaya, and in view moreover that the categories of the former like the methodology of the latter form integral aspects of the theoretical fundamentals of Ayurveda, the hypothesis of both originally developing in the circle of the ancient practitioners evidently deserves an intensive investigation.

Such a hypothesis would indeed be misunderstood if taken to mean that the Vaisesika and Nyaya as these come down to us are verbatim reproductions of the thoughts of the medical school.

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[76] B. Farrington, SPAW 66.

As detached from the original motive of serving the essentially practical therapeutic requirements, or as tending to attain higher and ever higher abstractions, both the philosophies understandably marked departure in many forms from what we read in the medical compilations. For the purpose of a more thorough discussion of the problems concerning the relation of the two philosophies to Ayurveda we have therefore preferred to add two separate appendices to our own study prepared by Mrinal Kanti Gangopadhyaya.

For the present we should like to mention only one point. It is concerning the origin of the Nyaya epistemology. As we have already seen, S.N. Dasgupta wants boldly to defend the hypothesis that the Nyaya epistemology had its origin in the medical circles. In this connection he mentions a very interesting evidence from Jayanta Bhatta's *Nyaya-manjari*. We can perhaps follow up this evidence a little further.

Jayanta Bhatta, one of the later representatives of Nyaya and one enjoying vast reputation, suggested that the essentials of Nyaya developed out of some other science or branch of knowledge—*sastrantarabhyasat*. Dasgupta does not fail to note this and observes, "Jayanta, in his *Nyayamanjari*, discussing the question of the possible sources from which Aksapada [the supposed founder of Nyaya] drew his materials, suggests that he probably elaborated his work from what he may have gathered from some other science (*sastrantarabhyasat*) ; but it is difficult to say whether by *sastrantara* Jayanta meant Ayurveda".[77] At the same time Dasgupta draws our attention to Jayanta's great reverence for Caraka : "Jayanta enters into a long discussion in his *Nyaya-manjari*, trying to prove that it was through his omniscience that Caraka could write his work and that he neither discovered the science by inductive methods nor derived it from previous traditional sources".[78]

Nevertheless there is an exceedingly interesting evidence in the *Nyaya-sutra*, elaborated by Vatsyayana's commentary (*bhasya*) on it which we can hardly ignore in this connection. Ostensibly, it is intended to prove the validity of the Veda or scripture, but the actual proof offered is, to say the least, most peculiar. We quote it at some length :

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[77] S. N. Dasgupta, ii. 398.

[78] *Ibid*. ii. 399.

> Is the validity of the Veda proved merely by refuting the objections raised against it ? No. Moreover, by (the evidence)—
>
> *Sutra* 68 : Like the validity of Mantra (as Mm. Phanibhusana has elaborately argued that in this context the word *mantra* is to be taken specifically in the sense of the spells of folk medicine rather than those of Vedas) and Ayurveda, its (i.e. of the Veda) validity is proved because of the trustworthiness of the person uttering it. [The validity of an utterance is established by the trustworthiness of the person uttering it. A trustworthy person is a speaker who has the direct knowledge of an object and is motivated by the desire of communicating the object as directly known by him. See Vatsyayana on *Nyaya-sutra* (i.1.7). This is palpably so in the case of Mantra and Ayurveda. On the same ground is established the validity of the Veda].
>
> *Bhasya* : What is meant by the validity of the Ayurveda ? It consists in its veracity, i.e. the absence of any opposition to facts. This means that the recommendation of the Ayurveda, viz. "one performing this attains the desirable and one avoiding it avoids the undersirable," when properly followed, the promised results actually take place. The validity of the *mantras* consists (in their veracity, i.e.) in this that when the spells intended to remove or dispel poison, evil spirit and lightning are uttered, these actually take place (i.e. poison etc. are actually removed).
>
> What is this (validity) due to ? It is due to the veracity of the trustworthy persons. But what, again, constitutes the veracity of the trustworthy persons ? The direct knowledge of what is prescribed, compassion for the living beings and the desire to communicate the objects rightly. The trustworthy persons, who have the direct knowledge of what they prescribe, express their compassion for the living beings (by way of advising): "this is to be avoided" and "this is the cause of pain", or "this is to be attained" and "this is the means of its attainment." For the ordinary living beings who cannot themselves understand, there is no other way of knowing all these except by such advice. Without the knowledge there can be no effort for their attainment and avoidance. And without such effort, there is no benefit for them. And there is no other means for attaining this benefit except such advice. (The trustworthy persons resolve): "We are going to advise them correctly, as we have ourselves observed, so that by listening to us they (i.e. ordinary persons) will acquire knowledge and thereby avoid the undesirable and attain the desirable."
>
> Thus the communications of trustworthy persons, being characterised by the three-fold veracity of their trustworthiness, when actually followed, become fruitful. Therefore, the communications of the trustworthy persons are sources of valid knowledge and the trustworthy persons are themselves the source of valid knowledge.

> From the (validity of the) Ayurveda, which is but the communication of an authoritative person about directly perceptible objects, is to be inferred the validity of the Veda (which is also a communication of trustworthy persons) about objects imperceptible. Further, the Veda is in part—e.g. in the injunction, "One desirous of a village should perform a rite"—a communication about perceptable objects. From (the validity of) this part is to be inferred (the validity of those parts of the Veda that communicate about objects imperceptible).
>
> In ordinary life also, there are many practices based on the advice (of authoritative persons). The trustworthiness of the advisers in ordinary life also is constituted by the direct knowledge of the objects spoken of, the compassion for others and the desire to communicate the objects rightly. (The communications of trustworthy persons in ordinary life) are also sources of valid knowledge because they are characterised by these (three).
>
> The validity of the Veda is also inferred from the identity of the seers and speakers. The trustworthy persons, who are the seers and speakers of the Veda, are themselves (the seers and speakers of) Ayurveda etc. Therefore, the validity of the Veda is to be inferred like (the inference of) the validity of Ayurveda. (ii.1.68)

The evidence of this passage is as decisive as it is impossible to imagine that it was later inserted into the source-book of Nyaya after the authority of rationalist medicine was firmly fixed. Far from the authority of rationalist medicine being firmly fixed in the course of time, the fact is that it came under strong censorship of Vedic orthodoxy and its spokesmen, particularly by those that framed the law-codes in the country (Dharma-sastra). Such a resistance to rationalist medicine is apparently peculiar and we shall have later in our *Appendix* the occasion to discuss its nature as well as its possible causes. For the present the point is that if the makers of the *Nyaya-sutra* and the commentary on it accepted Ayurveda as representing the model of validity only by conforming to which the Veda could be accepted as valid, they could do it either before the orthodox contempt for rationalist medicine became firmly fixed or by openly flouting the dictates of Vedic orthodoxy. In any case, we have here a strong evidence supporting Dasgupta's hypothesis that Nyaya epistemology presumably grew out of the methodology of Ayurveda rather than Ayurveda borrowing from Nyaya the epistemological discussions embodied in the *Caraka-samhita*.

But let us return to the main thread of our discussion.

We have seen before that the seeds of the scientific method were originally sown by Uddalaka Aruni. This must have been a tremendous achievement specially as judged in the context of his time. Retrospectively viewed, however, his scientific method may appear to be somewhat rudimentary,—a zest for simple observation supplemented by a rather simple form of experiment. However the methodology seems to have had tremendous potentials. The seeds originally sown by him evidently flourished as full-fledged epistemology already in the tradition of rationalist medicine and in all presumption it was taken up later by the philosophers of the Nyaya system with some modifications.

However, admitting such a relation between Nyaya and Ayurveda, a comparative study in the epistemology embodied in the two promises to be rewarding for our understanding of the theoretical fundamentals of natural science that developed in India. But such a study necessitates the analysis of a very large number of technical terms, into the weary details of which it would be inexpedient for us to digress in the present stage of our discussion.

Nevertheless the study itself is important and without it the understanding of the theoretical fundamentals of natural science in ancient India remains more or less incomplete. Hence, is the *Appendix VI* added.

38. NYAYA-VAISESIKA ATOMISM

Whatever may turn up by expert analysis of the possible sources of the Vaisesika categories in the medical tradition, one point needs to be specially noted. Our own analysis of the source-books of ancient Indian medicine has failed to show any clear enthusiasm for the atomic hypothesis. Nevertheless, any overview of the theoretical fundamentals of natural science that took shape in ancient India remains grossly incomplete without it because the fact is that atomism has by far been a very prominent feature of ancient Indian thought.

The exact origin of atomism in ancient India still remains a pointer to further research, though as we have already seen that there is scope to conjecture that already in the thoughts of Uddalaka Aruni it was perhaps somehow anticipated. In any case, it is indubitable that there were gropings for it in a number of very ancient sects like those, for example, of the Jainas. A.L.

Basham has moreover argued that the Ajivikas too were moving towards it. Admitting all these, one cannot escape the further admission that in these early sects atmoism awaited to assume the form of a sufficiently clear-cut independent scientific or proto-scientific hypotheses, inasmuch it remained more or less mixed up with certain hangovers of quasi-primitive mythological imagination. It was different however in the natural philosophy called the Nyaya-Visesika. In this trend of thought which Frauwallner boldly characterises as nature philosophy rather than bare speculations on the means for attaining liberation (*moksa*) the atomic hypothesis emerges in a clear form, pressing for recognition as an outstanding feature of the theoretical fundamental of natural science.

It is moreover of special importance to note that in the Indian tradition atomism was much more than a somewhat passing episode as it was in ancient Greece, not to speak of the ancient Chinese tradition where the atomic hypothesis never took any real root at all. By contrast, beginning from a very ancient period—how much ancient may be still really not precisely known.—it played an amazingly long innings in Indian thought. The outstanding idealist philosophers like Vasubandhu (*c*. 5th cent. A.D.) and others did their best to refute and reject it with sharp and sophisticated arguments. But these could not annihilate the enthusiasm for atomism, particularly because highly talented philosophers with a commitment to the naturalistic explanation of the world went on defending it with amazing tenacity and counter-sophistication. The defence of atomism therefore specially in the nature-philosophy of the Nyaya-Vaisesikas stretched over many centuries seems to be a unique feature of the scientific tradition of ancient India. In a sense this continued upto the latest representatives of traditional Indian thought. One is tempted to mention in this connection a legend about the famous Gadadhara who lived in the 17th century and is usually considered as the last of the outstanding philosophers of the genuinely Indian tradition. According to this legend, when Gadadhara was in his death-bed his relatives and students wanted him to remember God as the world-cause, for according to Indian orthodoxy this would have ensured heaven for his soul. But Gadadhara refused to oblige and his dying words were said to be "atoms, atoms, atoms" (*pilu pilu pilu*). We have no means of course to establish the veracity of such a legend. But it needs to be noted that Gadadhara belonged to the most conservative area of India called Navadvipa, which is normally expected to suppress such a virtual heresy rather than manufacture it.

We have mentioned all this only to emphasize one point. Any review of the theoretical fundamentals of the tradition of natural science in India remains necessarily incomplete without an overview of the atomic hypothesis specially associated with the Nyaya-Vaisesikas.

Fortunately, the team of collaborators working for the present project includes one, namely, Mrinal Kanti Gangopadhyaya, who for many years has devoted himself to the study of atomism in Indian thought, as is evidenced by the increasing international recognition being received by his monograph *Indian Atomism* (Calcutta 1980). It has therefore been only natural for us to have a special survey of the atomic hypothesis by him which we feel highly gratifying to use as our next chapter.

CHAPTER IX

THE ATOMIC HYPOTHESIS

Invited Contribution From

MRINAL KANTI GANGOPADHYAYA

It is wellknown that some of the prominent systems of Indian philosophy are realists. Since they all believe in the reality of the external world they also feel it necessary to offer a satisfactory explanation for its origin. It leads many of them to the atomic hypothesis, the prolonged history of which is undoubtedly a remarkable feature of Indian philosophical heritage. It had an almost unbroken history of about two thousand years of active confrontation with idealism and theology, during which it went on enriching itself by way of meeting the powerful polemics of the idealists against the various points and suppositions of this hypothesis. Thus, for instance, while atomism forms an antithesis (*vipaksa*) for Vasubandhu (*c*. 5th cent. A.D.), a Buddhist philosopher, and Samkara (*c*. 8th cent. A.D.), a prominent exponent of Advaita Vedanta, it remains a fundamental thesis (*paksa*) for Vatsyayana and Uddyotakara, both belonging to the Nyaya school. This dialectical confrontation of atomism with its anti-thesis results in Indian philosophy in the theoretical clarifications of various questions concerning the ancient atomic hypothesis.

Before going into the details of the atomic theory, it would perhaps be worthwhile to identify the advocates and the opponents of the atomic theory in Indian philosophy.

Regarding the Jainas there is no scope for doubt. They were definitely atomists ; the atom has been defined and its qualities have been enumerated in some of their early texts.

Among the Buddhists, we find both the opposing groups, the atomists and the anti-atomists. The Buddhists are broadly classified under two heads, the so-called Hinayana (comprising the two schools of Sautrantika and Vaibhasika according to another classification) and the self-styled Mahayana (comprising the two schools of Madhyamaka and Yogacara according to another classification). Of these, Hinayana which had an earlier origin believes in the reality of the external world and explains the formation of material objects out of atoms. The Mahayana, on the other hand, rejects the reality of the external world, and the Yogacaras in particular have criticized the atomic theory in very strong terms.

The Vedanta is very positively opposed to atomism. The *Brahma-sutra* itself devotes a number of *sutra*-s to prove the untenability of the atomic theory and thereby seems to oblige Samkara to examine and refute it in great details.

Though not pronouncedly enthusiastic about the atomic theory, the two schools of the Mimamsa, the Prabhakara and the Bhatta, appear to accept it in principle and cannot be termed definitely anti-atomists.

The Nyaya-Vaisesikas may be said to be the foremost champions among the atomists. From a very early period down to the seventeenth century A.D., through their numerous commentaries and independent works, they have tried to develop the atomic view and put it on a firm logical foundation, fighting against the onslaught of the anti-atomists. Thus, in later times, *paramanu-karana-vada* or the theory of atomic origin of the world came to be exclusively associated with the name of the Nyaya-Vaisesikas.

JAINA ATOMISM

For a general idea of this, it would be best to start with the brief account given by Jacobi. He writes : "Matter is an eternal substance, undetermined with regard to quantity and quality, i.e. it may increase or diminish in volume without addition or loss of particles, and it may assume any forms and develop any kind of qualities. Material substances may coalesce into one substance, and one substance may divide into many.

"Now, the Jains maintain that everything in this world, except souls and mere space, is produced from matter (*pudgala*), and that all matter consists of atoms (*paramanu*). Each atom occupies one point (*pradesa*) of space. Matter, however, may be either in the gross state (*sthula*, *badara*), or in the subtle (*suksma*). When it is in the subtle state, innumerable atoms of it occupy the space of one gross atom. The atoms are eternal as regards their substance ; each atom has one kind of taste, smell and colour, and two kinds of touch. These qualities, however, are not permanent and fixed for the several atoms, but they may be changed and developed in them.... The figures formed by the arrangement of the atoms into groups are manifold.... The atom may develop a motion of its own, and this motion may become so swift that by means of it an atom may traverse in one moment the whole universe from one end to the other.

"It is evident from what has been said, that there are not different kinds of atoms corresponding to the four elements, earth, water, fire and wind ; but though it is not explicitly stated, still we may assume that the atoms, by developing the characteristic qualities of the elements, become differentiated and thus form the four elements....

"We must mention the opinion of the Jains concerning *karma*, i.e. merit and demerit, in its bearing on the atomic theory. *Karma*, according to them, is of material nature (*paudgalika*). The soul by its commerce with the outer world becomes literally penetrated with material particles of a very subtle kind. These become *karma* and build up a special body, the *karmana-sarira*, which never leaves the soul till its final emancipation. Thus the atoms of which the *karma*-matter is composed are believed to be invested with a peculiar faculty which brings about the effects of merit and demerit". (*ERE* ii.199-200)

The Jaina theory of atoms is found fully developed already in some of its early works. The account in the *Pancastikayasara*, (*c*. 3rd cent. A.D.) though not detailed, defines and describes clearly the nature of *paramanu*. In the *Bhagavati-sutra*, the theory has been treated quite elaborately. Though somewhat loose and conversational in style, it touches upon the various aspects of the theory in some details. Some instances from the actual text may be given*:

[On the indivisibility of molecules (*paramanu*)]

Q. 113. Bhante ! Is it possible for molecules of matter to exist on the sharp edge of the sword or razor ?

A. 113. Yes, it is.

Q. 114. Bhante ! While staying there, do they get pierced and cut ?

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* Detailed references for this article are to be found in my book, *Indian Atomism* (Calcutta, 1980).

> A. 114. Gautama! They do not. The weapon has no effect on the molecules of matter. And like this... till with infinite *pradesas*.

Again—

> 318. That two matter molecules stick to each other; why do the two stick to each other? Because there are minute water-bodies between the two; and so two matter molecules stick to each other; if divided, they make two; and then there is one matter molecule on one side, and there is one matter molecule on the other side.
>
> 319. That three matter molecules stick to one another; why do the three stick to one another? Because there are minute water-bodies in them; and so three matter molecules stick to one another; if divided, there may be two divisions and also three divisions; with two divisions, there is one matter molecule in one part, and a bunch of two making a *skandha* in the other; with three divisions one by one, the three matter molecules remain apart and so... till four.
>
> 320. That five matter molecules stick to one another; and by sticking to one another, they make a *skandha;* and that *skandha* is transient, and it waxes and it wanes.

Thus it goes on to describe the main forms of matter, the formation and the characteristics of atoms, the definition of atoms, classification of atoms, relation of atoms with the aggregates of atoms, vibration and movement of atoms and such other allied topics.

As for instance, from different viewpoints, atoms are classified into four groups: (i) *dravya-paramanu* or an atom of substance, (ii) *ksetra-paramanu* or an atom of point of space, (iii) *kala-paramanu* or an atom of time, called *samaya* and (iv) *bhava-paramanu* or an atom of state, e.g. colour etc. Again, the characteristics of atoms are noted:

> One atom is equal to another atom from the point of view of substance. It is impenetrable and indivisible, incombustible and non-receivable (*agajjha*); *anardha* (without half part), *amadhya* (having no interior part) and *apradesa* (having no points or only one point);...... An atom may be a single substance or a part of a substance. It is so fine in form that it is touched by air, but it does not touch air. An atom and an aggregate of atoms are infinite in number, while the former is eternal from the aspect of substance and non-eternal from that of modes of colour, taste, smell and touch. It is the not-last (*accarima*) from the point of view of substance and it may be the last and not-last from that of space, time and state.

The theory was later taken up by the *Tattvartha-sutra* and in the form of short and pointed aphorisms it was clearly formulated. A number of commentaries on the work is available and they develop the hints of the *sutra*-s faithfully. However, the *Tattvartha-sloka-vartika* of Vidyanandin is rather inclined on the scholastic side and indulges very often in hair-splitting argumentation. Similarly, the later works, for instance, the *Prameya-kamala-martanda* and the *Nyaya-kumudacandra*, both by Prabhacandra Suri (*c.* 825 A.D.), are concerned more with the refutation of the non-Jaina atomists and resort to technical arguments, adding very little besides what has already been noted in the early basic texts.

BUDDHIST ATOMISM

As has already been noted, two schools of the Buddhists, the Sautrantikas and the Vaibhasikas, subscribe to the atomic theory. Both these schools admit the reality of the external things. But whereas the former holds that these can only be inferred, the latter claims that these can well be directly apprehended. It is difficult to form a definite idea about the former's position, for no important text of the school has come down to us. On certain specific points only, information as regards its position may be gathered from other Buddhist and non-Buddhist works, such as, the *Abhidharma-kosa* of Vasubandhu, the *Sarvadarsana-samgraha* of Madhavacarya, an Advaita Vedantist of the 14th century A.D., or the commentary on the *Sad-darsana-samuccaya* by Gunaratna, a noted Jaina author of the 15th century A.D.

We are somewhat luckier in the case of the Vaibhasikas in this respect. One of the most authoritative texts on the system, the *Abhidharama-kosa* along with the author's own *Bhasya* thereon and the well-known commentary of Yasomitra on them as well as another independent work, the *Bahyarthasiddhi-karika* of Subhagupta (*c.* 7th cent. A.D.) are now available to us.

Samkara, comprising both under the name of Sarvastivadins, gives, in the form of a very brief sketch, their views on the atoms in the following words :

> These Buddhists acknowledge the four elements, earth, water, fire and wind, with their properties and products, including the organs of sense ; the four elements are atomic ; the earth atoms have the quality of harshness, the water atoms that of viscidity, the fire atoms that of heat, and

the wind atoms that of motion; in combination, these atoms form the earthy things, etc.

To the above brief sketch some additions may be made on the basis of the *Abhidharma-kosa* (and its *Bhasya*).

According to it, things (*dharma*-s) may first broadly be divided into two classes, *samskrta*, the ones that are caused and *asamskrta*, the ones that are uncaused. The *samskrta* ones, again, are said to be of five kinds, called *skandha*-s, namely : (i) *vedana-skandha*, (ii) *samjna-skandha*, (iii) *samskara-skandha*, (iv) *vijnana-skandha* and (v) *rupa-skandha*.

Of these five, the last one only has relevance for our present discussion, for matter and its different forms are all included in it. Thus, under the head of the *rupa-skandha*, we have (besides others), the five sense-organs—the visual, the gustatory, the auditory, the olfactory and the cutaneous—which, according to the Vaibhasikas, are only special forms of transformed matter (*bhuta-vikara-visesa*); the five objects of the senses (viz, *rupa*, *rasa*, *gandha*, *sabda* and *sprastavya*); and the four material elements (viz. earth, water, fire and air).

The sense-organs are not only material, but also atomic in structure. Thus the *Abhidharma-kosa-bhasya* notes the peculiar structure of each :

> The atoms constituting the visual organ are arranged in the pupil of the eye in the shape of an *ajaji* flower. As they are covered by a transparent skin, they do not scatter away. Others say that these atoms are arranged in the manner of a lump, one over the other. But they do not envelop one another, because they are as clear as a crystal. The atoms constituting the auditory organ are arranged inside the ear-hole in the shape of a *bhurja* leaf.
>
> The atoms constituting the olfactory organ are arranged inside the nostrils in the shape of slender iron sticks (*salaka*).
>
> The atoms constituting the gustatory organ are arranged in the shape of the half-moon. The atoms constituting the cutaneous organ are arranged in the shape of the body itself.

The respective objects of the five senses also are stated to be of the nature of aggregates of atoms. Each of them is constituted of a group of atoms dissimilar in kind to the atoms constituting the others.

No single sense-atom or object-atom is capable of producing an awareness, for all forms of awareness relate to an aggregate. Of the five sense-organs, three—the gustatory, the olfactory and the cutaneous—apprehend an object which has the same number of atoms as the sense-organ itself apprehending it. In the case of the other two—the visual and the auditory—there is no fixed rule ; the sense-atoms may be equal to, greater or lesser, in number, than the object-atoms. As for instance, when one looks at a grape, the tip of a hair and the high mountain respectively ; or, when one listens to others' conversation, the humming of a mosquito and the roar of the cloud respectively.

The four material elements—namely, earth, water, fire and air —also are atomic. They have two kinds of properties, natural (*svabhava*) and derived (*upadaya*). The natural properties of the four are respectively : solidity (*khara*) viscidity (*sneha*), heat (*usna*) and motion (*irana*). Because of the presence of such specific properties in them, each is capable of a special function also. Thus, because of solidity, earth holds or acts as a support of other things (*dhrti*), e.g. the jar holds water. Because of viscidity, water causes cohesion (*samgraha*), e.g. grains of flour form a lump when water is poured into them. Because of heat, fire gives rise to chemical transformation (*pakti*) e.g. the black unbaked jar turns red when put into fire. Because of motion, air causes displacement and growth (*vyuhana=prasarpana* and *vrddhi*), e.g. a blade of grass is carried away by the wind or the sprout gradually grows into a plant due to the influence of air.

An atom is the smallest unit of matter, but it never occurs alone. What, then, is the smallest aggregate ? Jacobi informs us :

> The Sautrantikas seem to have regarded the aggregate of seven atoms as the smallest compound (*anu*). [cf. Hiuen Tsiang, *Si-yu-ki,* i. 60. In Pauranic measures 8 *paramanus*—1 *para-suksma* (Wilson, *Visnu Purana*, i.93n)].
>
> Their opinion seems to have been that the (globular) atoms did not touch one another completely, but that there was an interval between them ; but some held different views.

S.N. Dasgupta, stating that his source of information is the account of Sarvastivadin doctrines given by Sogen on the basis of the Chinese version of the *Abhidharma-kosa*, *Mahavibhasa-sastra* etc., writes :

> It (atom) cannot be pierced through or picked up or thrown away. It is indivisible, unanalysable, invisible, inaudible, untastable, and intangible. But yet it is not permanent, but is like a momentary flash into being.... Seven such *paramanus* combine together to form an *anu* and

it is in this combined form only that they become preceptible. The combination takes place in the form of a cluster having one atom at the centre and others around it.

According to the *Abhidharma-kosa*, the smallest aggregate seems to be composed of not less than eight atoms, but there is no hint as to their relative position. There is reference to a variety of very small aggregates, the number of their constituent atoms ranging from 9 to 11. Such aggregates may first be divided into two groups, non-sounding (*asabda*) and sounding (*sasabda*) and each of them again may be of three varieties. These may be listed as follows :

A(i): An aggregate, non-sounding and without any sense-organ : 4 atoms of the four elements (i.e. one each of *prthivi-ap-tejas-vayu*) + 4 atoms of the derived properties (i.e. one each of *rupa-rasa-gandha-sparsa*) = 8 atoms.

A(ii): An aggregate, non-sounding but with a sense-organ : 8 atoms as in A(i) + 1 atom of the cutaneous organ = 9 atoms.

A(iii): An aggregate, non-sounding but with sense-organs: 9 atoms as in A(ii) + 1 atom of any one of the visual, the auditory, the olfactory and the gustatory organs = 10 atoms.

B(i): An aggregate, sounding but without any sense-organ : 8 atoms as in A(i) + 1 atom of *sabda* = 9 atoms.

B(ii): An aggregate, sounding and with a sense-organ : 9 atoms as in A(ii) + 1 atom of *sabda* = 10 atoms.

B(iii): An aggregate, sounding and with sense-organs : 10 atoms as in A(iii) + 1 atom of *sabda* = 11 atoms.

NYAYA-VAISESIKA ATOMISM

The *Vaisesika-sutra of Kanada* (*c.* 1st cent. A.D.) is the earliest basic text in the whole range of the Nyaya-Vaisesika literature. There we find the word *anu*, but not the word *paramanu*, in the senses of an 'atom' as well as 'very small'. Though, in the absence of any early commentary, it is difficult to work out exactly the implications of the *sutra*-s, there is no doubt that we have in the *Vaisesika-sutra* a fairly developed form of the atomic theory. Thus, for instance, Kanada offers indirect arguments to prove the atom, enumerates their qualities, specifies their dimension as globular (*parimandala*), points out that the qualities as residing in the earth-atoms are changeable by heat (*pakaja*) and also distinguishes the various uses of the word *anu*.

Prasastapada (*c.* 5th cent. A.D.), the author of the *Padartha-dharma-samgraha* which is claimed by some to be a *Bhasya* on the *sutra*-s of Kanada, uses both the words *anu* and *paramanu* for an atom and develops the theory further by clarifying some of the main tenets. He devotes a separate section to explain the origin and destruction of the physical world, how things are gradually produced out of atoms after creation starts and how they are dissolved into atoms ultimately at the time of *pralaya.* The allied theory of *pilu-paka*—that the chemical change due to heat takes place not in the thing as a whole, but in every individual atom—is also treated in a separate section. Moreover, as Jacobi points out, Prasastapada was the first to introduce the dyad or *dvyanuka*, the first product out of the atoms.

Further subtleties and refinements of the theory and some later modifications, from the Vaisesika standpoint, are mainly to be found in the *Vyomavati*, the *Kiranavali* of Udayana, the *Nyaya-kandali* of Sridhara, the *Setutika* of Padmanabha Misra, all commentaries on the work of Prasastapada, the first one being the earliest, and the *Upaskara* of Samkara Misra, a commentary on the *sutra*-s of Kanada.

The *Nyaya-sutra* (*c.* 200-500 A.D.) of Gautama mainly concerns itself with the atom as such. In no less than ten *sutra*-s (iv.2.18ff), comprising the whole of one separate section and the concluding portion of another, Gautama hints at how the atom is to be arrived at and strongly defends its reality as a partless entity against the onslaught of the opponents. The view that the world is produced out of atoms and not from a single ultimate principle called *avyakta*, as the Samkhya claims, is also pointed to in one of the *sutra*-s and another *sutra* refers to the theory of *pithara-paka*—that the chemical change due to heat takes place also in the thing as a whole.

The *Nyaya-sutra* found a very able exponent in Vatsyayana, who in his commentary, called the *Nyayabhasya*, faithfully brings out and substantiates the implications of Gautama, and also advances his own ideas and arguments to silence the opponents. Thus, for instance, he clearly explains with an illustration the process of arriving at the impartite atom, justifies etymologically the use of the term *paramanu* for it and provides a clue to the most generally referred to absurdity which the non-admission of the atom would lead to, namely that of the seed and the mountain being equal in magnitude.

After Vatsyayana, the task of defending the Nyaya position was taken up by Uddyotakara and Vacaspati, who undoubtedly were successful to a great extent in their mission. Especially, Uddyotakara started a relentless tirade against the strong attack of the Mahayana Buddhists on the conception of the partless atom. He explained and examined the opponent's views in minute details and subjected them to a vigorous criticism. And in this task he was ably assisted by Vacaspati.

Although the atomic theory is dealt with, briefly or elaborately, and is referred to in various contexts in almost each and every later work of the Nyaya-Vaisesika school it was fully developed in the writings of Vacaspati. The later author's novelty mainly lies in the way of presentation and the clarification of ideas already current. There are however two exceptions, Raghunatha Siromani (*c.* 16th cent. A.D.) and Padmanabha Misra (*c.* 13th cent. A.D.), who did not subscribe to the generally accepted Nyaya-Vaisesika view of the atoms. Raghunatha argues that the visible triad (*tryanuka*) can very well be accepted as the ultimate unit of matter ; the admission of the dyad and the atom is unnecessary. Padmanabha, slightly differing, maintains that the ultimate unit should be either the dyad or the triad. However, both agree that such a unit is indivisible.

According to the Nyaya-Vaisesikas, there are four kinds of atoms corresponding to the four material elements, namely, earth, water, fire and air. These are not homogeneous, as the Jainas hold, but differ qualitatively. The Nyaya-Vaisesikas admit twenty-four qualities in all, which are divided into two groups, *samanya-guna*-s or general qualities that reside in more than one substance and *visesa-guna*-s or specific qualities that reside in one substance only. The qualities of conjunction, disjunction, number, magnitude etc. come under the first group and the qualities of colour, taste, smell etc. belong to the second group. The atoms differ so far as the specific qualities are concerned. Thus, though all the atoms equally share the globular (*parimandala*) magnitude, of the various specific qualities, an earth-atom has colour, taste, smell and touch (temperate); a water-atom has colour, taste and touch (cool); a fire-atom has colour, and touch (hot), and lastly, an air-atom has touch (temperate) only. All the qualities of the atoms are eternal, excepting the four—colour, taste, smell and touch—as located in the earth-atoms, for they are changeable by heat.

At the beginning of a new creation, the atoms are set in motion —motion that unites one atom with another to form the countless varieties of things—by the force of *adrsta* or merit and demerit. According to the Nyaya-Vaisesikas, the production of substances out of the atoms occurs in a distinct order : first, only two atoms combine to form a dyad or *dvyanuka* and then, three dyads combine to form a triad or *tryanuka*, the smallest visible substance. Neither three atoms nor two dyads together can produce any substance. It is to be noted that each and every conjunction between atoms does not give rise to a new substance, and accordingly, the conjunction of atoms may be either productive (*arambhaka*) or non-productive (*anarambhaka*). A productive conjunction can occur only between atoms of the same kind and never between atoms of a dissimilar kind. Thus, for instance, two earth-atoms or two water-atoms may combine to form an earth-dyad or a water-dyad, but an earth-atom conjoined to another water-atom will not produce a new substance.

MIMAMSA ATOMISM

The atomic theory, though accepted in the Mimamsa system, did not evidently create much interest among its adherents, and very little reference to it is to be met with in Mimamsa literature of either school, the Prabhakaras and the Bhattas.

Not even the briefest account of the atomic theory is recorded in any of the major works of the Prabhakara school. In the *Prakaranapancika* of Salikanatha (about 9th cent. A.D.), we have just a reference to the atom ; that partless substances (*adravyadravya*) are of two kinds, the ubiquitous (*parama-mahat*) and the most minute (*paramanu*). There is a work belonging to the Prabhakara school, called *Prabhakaravijaya* by Nandisvara which, in a separate chapter, gives a detailed account of the atomic theory touching upon most of the important aspects. But unfortunately its date is totally uncertain, and from internal evidence it is clear that it must be a very late work. Thus the treatment of the atomic theory there seems to show very little originality and an unmistakable stamp of being influenced by the ideas of the atomists of other schools.

Coming to the Bhatta school, we find a reference to atoms in Kumarila's *Slokavartika*. But it is rather difficult to decide what he is inclined to accept as the ultimate unit of matter, the *paramanu* or the *tryanuka*. Parthasarathi Misra, a well-known follower of Kumarila, clearly states in his *Sastra-dipika* that an atom is the ultimate unit. But the *Manameyodaya* written with the avowed purpose of explaining the teachings of Kumarila definitely rejects the atom of the Nyaya-Vaisesikas and argues that the triad should be accepted as the final unit.

PROOFS FOR THE ATOM

(i) *Scriptural evidence*

After pointing out a number of logical inconsistencies involved in the atomic theory, the *Brahma-sutra* finally adds a special ground for its rejection : that this doctrine of atoms has not been accepted, even partially, by any authority versed in the infallible Vedas. The charge, in simpler terms, is that the atomic theory is non-Vedic. The charge—a charge indeed from the standpoint of the *Brahma-sutra* and its followers who claim 'systematically to interpret the teachings of the Upanisads'—is, it may be noted, true. For, 'in the oldest philosophical speculation of the Brahmanas as preserved in the Upanisads, we find no trace of an atomic theory'. However, the adherents of the Nyaya-Vaisesika school in general did not feel much concern at this alleged deficiency and did not take up the task of arduously discovering some Vedic passage—even if obscure and remote—referring to an atom. Considering the absence of Vedic sanction a precondition for rejection is too naive a way of refutation to be taken seriously, and in fact, in that case, it would be difficult to determine how much of the system itself would retain any relevance.

In this respect Udayana provides the solitary exception. In the *Nyaya-kusumanjali*, he quotes a verse from the *Svetasvatara Upanisad* (iii.3) and, offering his own explanation of the same, contends that the verse supports the thesis that the physical world is created by God, according to the merits and demerits of the various living beings, by conjoining the atoms together.

(ii) *Inferential evidence*

In the various texts of the atomists, we find mentioned at least three inferences that seek to prove the atom. Of these, the one based upon the idea of the 'varying degree of minuteness' (*anu-parimana-taratamya*) coming to a rest (*visranti*) appears to be the most current one.

The two earliest references to this inference occur in the *Nyaya-kandali* of Sridhara, a Vaisesika work and the *Nyaya-kumuda-candra* of Prabhachandra, a Jaina work.

The implication of the inferential argument is as follows. Roughly speaking, magnitudes (*parimana*) can be said to be of two kinds : large (*mahat*) and small or minute (*anu*). It is moreover an indisputable fact that there are variations in the degree of each magnitude. Thus, for instance, an apple, a mango and a melon are all large ; still, the melon is the largest of the three and the mango is larger than the apple. In the same way, a chip of stone, a mustard seed and a grain of sand are all small ; still, the grain of sand is the smallest of the three and the mustard seed is smaller than the chip of stone. But this variation of degree, as we find in the case of the large magnitude, comes to rest—reaches the highest limit—in a substance which is all-pervasive (*vibhu*), no substance larger in magnitude than which is possible, such as *akasa* or *kala*. In the same way, it would be only logical that the minute magnitude too must come to rest somewhere—reach the lowest limit—in a substance nothing smaller in magnitude than which is conceivable. And the atom is nothing but this substance with the smallest possible magnitude.

(iii) *Argument based on reductio*

The argument for the atom based on reductio may be considered an exclusive property especially of the Nyaya-Vaisesikas, and in later time became the sole defence for the reality of the atom. The gist of the argument is that unless some impartite substance at which the process of division comes to a rest and which is the ultimate component part of things is admitted, it would not be possible to speak of such distinctions of things as 'small', 'minute', 'large', 'huge' and the like.

The earliest hint at this line of argument was given by Vatsyayana, which has been later explained and illustrated by different writers in their own ways.

Uddyotakara has said that if the process of division does not end at the atom, even the triad (*truti*), the smallest visible substance, would become as immeasurable (*ameya*) as a mountain (*himavat*) in respect of the number of component parts (*samkhya*), magnitude (*parimana*) and weight (*gurutva*), since both would have to be considered as equally composed of an infinite number of parts (*ananta-avayava*).

Later Nyaya-Vaisesika writers show the absurdity as relating to magnitude only. The *Vyomavati* illustrates it with the instance of the round earth (*golaka-rupa prthivi*) and the jar etc. becoming identical in proportion. It adds further that if no eternal (material) cause in the form of the atom is admitted, new creation, after the period of cosmic dissolution (*pralaya*) is over, would not take place. All things, being non-eternal, would perish at the time of dissolution and non-existence (*abhava*) only would prevail. But non-existence can never be a material cause (*samavayi-karana*) and no effect can be produced in the absence of such a cause.

Vacaspati Misra had for illustration the undue equality of *meru* (mountain) and *sarsapa* (mustard-seed), and since then, among the atomists, especially the Nyaya-Vaisesikas, *meru-sarsapa* became almost a byword in the context of the atom.

In some works of the Bhatta school of Mimamsa, the absurdity is put in a slightly different manner : If there is no limit to division, even a mustard-seed would have an infinite number of parts, and theoretically, should itself fill up the whole earth.

PROBLEM OF ATOMIC COMBINATION

Perhaps the most challenging problem that the atomists in Indian philosophy are confronted with is the problem of the combination of atoms. Why should one atom be combined with another atom ? Is it some property located in the atoms themselves or something external to them that brings the atoms together ?

At least three different answers have been proposed.

The Jainas claiming that their view is corroborated by common experience—for instance, particles of barley-meal (*saktu*) come together and form one lump when drops of water fall upon them—maintain that generally a viscid (*snigdha*) atom may combine with a dry (*ruksa*) atom. Some atoms are by nature viscid and some atoms are by nature dry. A combination may take place between these two kinds of atoms. However, there are different degrees of viscidity and dryness, and it is not that a combination takes place everywhere. The exact degrees that are capable of combination and the ones that are not have been discussed in the *Tattvartha-sutra.*

Here it would perhaps be interesting to note the difference of the Jaina view from that of the Nyaya-Vaisesikas. A product resulting from the combination of a viscid and a dry atom would be an impossibility in the latter's view. It is possible in the Jaina view because they consider all atoms to be homogeneous and, according to them "Even the four-fold distinction of earth, water, fire and air is dervied and secondary, not primary and eternal as believed by some Hindu thinkers like the followers of the Vaisesika." But, according to the Nyaya-Vaisesikas, the division of the elements is fundamental and the four kinds of atoms are qualitatively different from one another. Thus viscidity (*sneha*), being a property of the element of water alone, would be present in water-atoms only and the other three kinds of atoms will all be dry. Moreover, they argue that a productive conjunction can occur only between two atoms of a similar kind, but never between two atoms of a dissimilar kind. Thus the combination of a viscid and a dry atom, which is productive in the Jaina view, would be non-productive in the Nyaya-Vaisesika view. Again, the combination of two viscid atoms (e.g. two water-atoms) or that of two dry atoms (e.g. two fire-atoms) is productive according to the latter (forming water-dyads or fire-dyads) but would be non-productive according to the former.

Of the Buddhists, Subhagupta gave an answer of his own to the problem. According to him, while forming an object, the atoms do not enter into actual combination, but are accumulated together. The cause of such accumulation is some potency inherent in the substances (i.e. the atoms) themselves (*dravyasakti*). Just as because of its inherent power a charm (*mantra*) can draw out the snake and make it immovable, so also because of the inherent potency atoms are drawn together (*samgacchante*) and get accumulated. The whole world is formed in this way. However, it is not that all atoms invariably share this potency or have it in a sufficient degree. Thus there may be many atoms there, lying separately, which never get accumulated due to the complete absence or presence in a lower degree of this potency in themselves.

Another point Subhagupta draws our attention to is that, in an accumulation, the atoms due to their very close proximity may mutually influence themselves and undergo transformations. Thus the atoms of a piece of diamond (*vajra*), for instance, undergo a peculiar transformation due to accumulation and become too hard to be disintegrated.

According to the Nyaya-Vaisesikas, in the production of composite things, conjunction of the parts plays an indispensable role. Thus, at the beginning of creation, initially a conjunction between two atoms must come about so that the first product out of the atoms—the dyad—may be produced and the process of creation may start. But conjunction is generally brought about by movement (*karman*). But the question is : Why should there be movement in the atoms at the beginning of creation ?

From what Kanada repeatedly asserts, the early Vaisesika position was : 'The cause of creative motion is believed to be *adrsta*, unseen moral force which guides the destiny of souls according to their *karma* and requires them to be provided with properly equipped bodies and an appropriate objective world for the experience of pleasure and pain. It is due to the operation of this metempirical force that atoms start moving to get together in order that they may be integrated into countless varieties of things'. Prasastapada adds later two more conditions, the will of God (Mahesvara) and a conjunction of the atoms with the individual selves (*atmanu-samyoga*).

In the *Nyaya-sutra* itself we do not find any reference in this regard. But the later Naiyayikas like Uddyotakara and others, though accepting *adrsta* as the cause of the said movement, brings in the agency of God also. In fact, Udayana takes it to be an invincible proof for the existence of God. His implications come to this. The atoms as well as the *adrsta* causing movement in them are all nonsentient. But, as is borne out by common experience, such things cannot by themselves produce effects ; they must be guided by some conscious, intelligent agent, who is none other than God.

The above is how the Nyaya-Vaisesika position is generally represented, and there is no doubt that it is true so far as the later representatives are concerned.

However, it would also be unjust to overlook the fact that the real implication, as regards movement due to *adrsta*, of the early

Nyaya-Vaisesikas—of the Vaisesikas at least—might have been something different. For this, it would be necessary to understand what they meant by *adrsta*. In later works, it is invariably explained in the sense of *dharmadharma* (merit and demerit), belonging to the category of quality. It is moreover a specific quality (*visesaguna*) of the individual self, that is, belongs to the self only and not to any other substance. But it appears that this was a later modification and originally it meant, considering the literal meaning of the word, the 'unseen', the unknown cause, i.e. some cause the exact nature of which cannot be determined, but nevetheless its existence has to be postulated to explain certain effects which cannot be explained by any well-known or ordinary causes. As Kanada himself illustrates, this 'unseen force' may operate in the physical as well as the non-physical spheres. Thus, in the physicial sphere, *adrsta* is the cause of the upward motion of fire, the oblique motion of air, the movement of iron towards the magnet, capillary motion as of liquid particles from the root to the stem of a plant, etc. In the non-physical sphere, *adrsta* explains the facts like 'the conjunctions and disjunctions of souls with their organic vehicles (bodies), etc.' And thus Kanada repeatedly asserts that, at the start of a fresh creation, movement in the atoms is due to *adrsta*.

ORIGIN OF ATOMISM

Although Jacobi categorically states that no trace of the atomic theory is to be found in the Upanisads and Ui also agrees with him, Barua thinks that some hint at the theory may be contained in the views of Uddalaka Aruni, preserved in the *Chandogya Upanisad*. Thus Barua explains : 'What was the original condition of the Matter, and how were concerete things gradually formed from it? Uddalaka's reply to this is.... Matter was at first a chaotic mass, like the juices of various trees indiscriminately blended together in honey. In order to develop names-and-forms, to discriminate things from one another, or to set them in order, the universal spirit came not in its universal form but as the living principle, and entered into Fire, Water and Earth. After separating their component but qualitatively distinct parts (*dhatu*-s), it made numerous new combinations of them. By propounding the theory of combination and separation of particles, Uddalaka anticipated the atomic theory of Kanada....'

The ground given by Barua for considering Uddalaka a forerunner of Kanada in respect of the atomic theory is that Uddalaka propounded the theory of the combination and separation of particles. In the Vaisesika view, it may be noted, conjunction and disjunction are given an important role so far as the material products are concerned. Thus, production and destruction mean, according to it, only the conjunction and the disjunction of the component parts respectively. The process of creation (*srsti*) starts when movement is produced in the separated atoms and it compels them to get joined to one another ; and again, the process of dissolution (*pralaya*) starts when movement is produced in the atoms constituting the body etc. and it compels them to get separated from one another. It may thus appear that the contention of Barua is not totally without plausibility.

Although Barua does not mention them, there are certain other grounds, perhaps more convincing, for the conclusion he sought to arrive at.

It has already been noted that generally the atomic theory was subscribed to and opposed respectively by the realists and the idealists. And, therefore, above all, a materialist who explains all reality in terms of matter alone would be eminently suited to become the original exponent of an atomic theory. Now, scholars of repute have sought to show that Uddalaka Aruni, probably the first Indian philosopher, was a hylozoist, i.e. a primitive materialist, or, at least he taught some materialistic doctrines. If this conclusion be considered acceptable, perhaps it would not be too much far-fetched to assume that Uddalaka's doctrine might have had the potentiality for developing a leaning towards the atomic theory.

Moreover, some internal evidence for a hint at the atomic theory may be traced in the *Chandogya Upanisad* itself. A question was put to Uddalaka by his son Svetaketu : How does this immensely gross (*atyanta-sthula*) physical world come out of the infinitesimal (*atyanta-suksma*) *sat* which is said to be the root-cause of all ? Would you kindly explain it to me with an illustration ? This is how Uddalaka demonstrated it with a common and easily available object :

U : Get a fig from the yonder tree.
S : Father, here it is.

U : Crush it.
S : Father, I have crushed it.
U : Now, what do you find ?
S : Father, I find all these grains which are very minute.
U : Take up any one of these grains and crush it further.
S : Father, I have crushed it further.
U : What do you find there ?
S : I find nothing.

Uddalaka then goes on to explain that, even though, when the grains of the crushed fig are divided, nothing visible to the eye remains, yet all these invisible particles actually constitute the grains which are 'large' in comparison, and these grains again form the still larger fig itself. And from this small fig-seed grows up the immense tree with its great trunk, thick branches and innumerable leaves. In the same way, this gross physical world comes out of the very minute *sat*. Now, as scholars have argued, if this *sat* of Uddalaka be really identical with matter, we have here an inkling of the atomic theory, for the present instance tends to illustrate the notion that the gross world is produced from very minute elements of matter, which is one of the most basic ideas behind the atomic theory. The instance moreover distinctly reminds one of the process, later widely accepted among the atomists, for arriving at the atom as the ultimate constituent for matter. (cf. Vatsyayana on *Nyaya-sutra* iv.2.16)

Another scholar, Ui, seeks to trace the origin of atomism outside Upanisadic literature. He thinks that the atomic theory might have actually developed from Sassata-vada or the doctrine of eternalism as advocated by Pakudha Kaccayana (Skt. Kakuda Katyayana), who was an elder contemporary of Buddha and was mentioned along with other sophists (*tirthika*) in the Buddhist annals.

Of course, Ui has warned that it would be too much to expect, in Pakudha Kaccayana's opinions, anything in the nature of a clear hint at an atomic theory : ". . . but there is yet no trace of an atomic theory, because the elements are called *maha-bhuta* or *kaya* and the earthy, etc., in a body return to the corresponding elements. That the body is built up of the elements is not a production, but a combination or aggregation, because the elements cannot be made nor be created, and they are barren. How or by what sort of force they are combined is not explained."

Some other scholars have tried to determine the special circumstances which might have led to the formulation of the atomic theory in Indian philosophy. They think that a situation similar to the one in which atomism in Greece found its advent arose in the case of the Indian philosophers also. Thus it is suggested that just like Greek atomism which was a synthesis of the two opposed views of Parmenides and Heraclitus, Indian atomism too was a synthesis of the Brahmanical (Upanisadic) and the Buddhistic speculations.

Explaining the reason for the wide acceptance of the atomic theory among the schools of Indian philosophy, Jacobi writes : "When once firmly established, the atomic theory must have had much persuasive power with many philosophers ; for it put in place of the primitive conception of matter as an eternal but quite undefined substance the more rational notions which offered an intelligible explanation of the perpetual change of things while still maintaining the eternity of matter."

APPENDICES

APPENDIX I

EARLY HISTORICAL INDIA : A STUDY IN ITS MATERIAL MILIEU. (C. 600 B.C.—300 A.D.)

RANABIR CHAKRAVARTI

I

Researches in early Indian history over the last three decades show a major change in historical vision : the earlier emphasis on dynastic chronicling is increasingly being replaced by the historian's penchant for understanding the economy, society, polity and culture of early India. Historians appear to have been now less interested in what Kosambi termed as 'episodic history'[1] and engage themselves in unravelling the changing character of early Indian history and also indentifying the possible agents of such changes. One of such formative stages of Indian history is termed 'early historical' which spans from sixth century B.C. to third century A.D. and which succeeds the proto-historic/pre-literate phase in the history of the subcontinent.

The period witnessed rise of territorial powers (*janapadas/ mahajanapadas*) in the place of lineage-based polities (*janas*); it also saw a continuous struggle between the urge for imperial unity and the love for local autonomy (expressed mainly by the 'republican'/oligarchic or *gana-samgha* type of polities).[2] The intellectual turmoil that came in the wake of the Second Urbanization is already discussed in the earlier chapters of the present work. The most important change in the economic life was the emergence of agriculture as the mainstay of the material life of the people first in the Gangetic valley and then gradually over the whole of the subcontinent. The agrarian economy when firmly rooted naturally provided enough surplus to maintain wholetime craftsmen of diverse types. As production increased both in the spheres of agriculture and crafts, trade developed in a natural sequence. The early centuries of the Christian era ushered in a

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1. D.D. Kosambi, *An Introduction to the Study of Indian History*, Bombay, 1970, 1.
2. H.C. Raychaudhuri, *Political History of Ancient India*, Calcutta, 1972, 166-69.

glorious phase of Indian commerce which was drawn into the network of international trade, both overland and maritime. The new generative forces must have helped in transforming an essentially lineage-based and more or less egalitarian society into a stratified society. Symptoms of a complex society are discernible in the form of sharpening of *varna-jati* differentiation and in the emergence of classes. These broad developments, spanning over about nine centuries, can hardly be expected to have occurred in a uniform and unilinear manner in a vast spatial unit like the Indian subcontinent.

There is however a major point of unity in the changing socio-economic and cultural scene and that is the process of urbanization. Though the earliest cities appeared in the subcontinent as far back as the days of the Harappa civilization (c. 2300-1750 B.C.)[3] urban centres virtually vanished from the scene between 1500 and 600 B.C. It is from the sixth century B.C. onwards that the historian encounters a spurt of urban centres, first in the middle Ganga basin and then gradually throughout the subcontinent.[4] The question is so far undecided whether urbanization in the Ganga basin was a survival or revival of Harappan urbanism; but majority of present-day scholars view urbanization in the early historical period as independent of its proto-historic counterpart.[5] The difference between the two urbanisms is not merely temporal but also visible from the point of view of its socio-economic, political and cultural milieu.

This requires an exhaustive discussion. But one should try to understand at the outset what is a city.

There are several definitions of an urban centre. Despite the multiplicity of such definitions and concepts of a city, the city can best be seen as a unit of human settlement sharply distinct from a village. The difference between a city and a village is marked by the "oldest and most revolutionary division of labour : between the work in the fields on the one hand and the activities described as urban on the other."[6] The essential hall-marks of a pre-industrial if not pre-historic, city were summed up by Gordon Childe in 1950.[7] These are :

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[3] Bridget and Raymond Allchin, *The Rise of Civilization in India and Pakistan*, Cambridge, 1982.

[4] Harappan cities mark the first stage of urbanization followed by the one in the Ganga Valley after about a millennium, the latter being known as the 'second urbanization' in India.

[5] A. Ghosh, *The City in Early Historical India*, Simla, 1973, particularly ch. VI, entitled 'Survival ? Revival ? Import ?'

1. A city is much more extensive and densely populated than any previous human settlement.
2. Though peasants were often found just outside the city, the main inhabitants of the city consisted essentially of non-food-producing people, i.e. full-time specialist craftsmen, merchants, priests, rulers and administrative officers, who were supported by the surplus produced by peasants.
3. The primary producer is to pay a tiny part of the agricuutural surplus to a deity or divine king. The concentration of this surplus is essential for the emergence of cities.
4. Construction of true monumental buildings is a distinctive mark of city life ; it is also indicative of the concentration of social wealth.
5. Among the non-food-producing population of an urban centre, priests, civil and military leaders and officials enjoyed a position of pre-eminence. They claimed the major share of the concentrated surplus and that led to the formation of ruling class.

6-7. Invention of writing, rise of a community of clerks and the elaboration of exact and predictive sciences—arithmetic geometry and astronomy—are inseparably associated with the emergence of an urban centre.

8. Other specialists gave a new direction to artistic expressions. Artist-craftsmen, sculptors, painters, seal cutters etc. began to practise their craft according to conceptualized and sophisticated styles.

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[6] Fernand Braudel, *Structures of Everyday Life*, London, 1981, 479.

[7] V. Gordon Childe, 'The Urban Revolution', *The Town Planning Review* XX.1, April, 1950, 3-17. Childe's formulations were based on the evidence of the emergence of first cities in the ancient Near East, Mesopotamia and Indian subcontinent. Several modern sociologists and urban historians have questioned his formulations. See Gideon Sjoberg, *The Preindustrial City of Past and Present*, New York, 1960 and Lewis Mumford, *The City in History—Its Origins, Its Transformations and Its Prospects*, London, 1961.

9. A part of the concentrated surplus is meant for paying for the importation of raw materials. Trade and market and especially long-distance trade are closely linked up with city life.
10. The specialist craftsman in a city is provided with raw material and guaranteed security in a state organization based on residence rather than kinship. The city is a community to which a craftsman can belong both economically and politically.

The above criteria when closely examined would show that the basic motivating factor behind the process of urbanization was betterment of technologies which paved the way for the production of the vital surplus. This surplus not only sustained the non-food-producing population of the city but also the ruling group.

Significant changes took place in the fields of production of surplus and the methods of channelization of the surplus from the days of the Harappan civilization to those of the urban development during the early historical period. The Harappan civilization depended on bronze and stone implements for agrarian production. We are still in the dark regarding the nature of the ruling class in the Harappan civilization, but a considerable number of scholars are of the opinion that some kind of a sacerdotal authority controlled the affairs of the Harappans.[8] It has also been suggested that the exact sciences (arithmetic, geometry

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8. It is extremely difficult to pass any final judgment about the nature of authority in the Harappan civilization, as no written material can be used for this purpose. There is however, considerable evidence to show that priests did play an important role in the management of affairs in Egyptian and Mesopotamian civilizations, the two near contemporaries of Harappan civilization. According to Childe, "magic and religion constituted the scaffolding needed to support the rising structure of social organization and of science. Unhappily the scaffolding repeatedly cramped the execution of the design and impeded the progress of the permanent building........ The principal beneficiaries from the achievements of farmers and artizans were priests and kings. Magic rather than science was thereby enthroned and invested with the authority of the temporal power". Gordon Childe, *Man Makes Himself*, London, 1965, 236. On the analogy of the situation in Egypt and Mesopotamia, it is suggested that the Harappans were also ruled by a similar group of priests.

and astronomy) which were inseparably associated with the emergence of first urbanization were also intermixed with magico-religious beliefs and practices, obviously to the advantage of the priestly community.[9] Attention has also been paid to the relative scarcity of offensive weapons and defensive body armours during the Harappan civilization. D.P. Chattopadhyaya argues, taking the cue from D.D. Kosambi and Joseph Needham, that in the absence of true implements of coercion the ruling groups took recourse to magical and superstitious beliefs which were intertwined with exact sciences.[10] Chattopadhyaya hints at a distinct possibility that[11] this religious ideology was the main instrument in Harappan culture for the purpose of policing the state. Thus the exact sciences at once facilitated the growth of urbanism and instead of emancipating people from superstitions went hand in glove with the latter for controlling the ruled and for channelizing the social surplus.

The period intervening between the fall of the Harappan and the emergence of the Gangetic urbanism witnessed no cities. Moreover the Dharmasutras speak of definite hostility towards cities and the *Rgveda* shows that a pastoral economy prevalied from *c.* 1500-1000 B.C. The subsequent period of the Later Vedic literature signalled expansion of the Vedic people from the Punjab towards the east, south and south-east. The most important aspect of this immigration was the settlement of sedentary agricultural communities, distinct from the pastoral people of the Early Vedic period in the upper, and then gradually, in the middle Ganga basin. The transformation of the pastoral Rgvedic society to a fully agrarian community during the Later Vedic phase is one of the most significant developments in the economic history of early India. While definite facts about the growth of agriculture are known in this period, the idea of private property and the growth of royal power can also be noticed from a study of the Later Vedic literature. To this one can add some progress in crafts and industries and the beginning of the use of iron.[12]

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[9] V. Gordon Childe, *Man Makes Himself*, 236.

[10] D.P. Chattopadhyaya, *History of Science and Technology in Ancient India*, Calcutta, 1986, 336 ff.

[11] D.P. Chattopadhyaya, *ibid*, 350.

[12] There is some controversy regarding the beginning of the use of iron in ancient India. Though the term *ayas*, often taken in the sense of

This is the period which marked the growing ritualization in social and religious life which consequently led to the increasing importance of the priestly community, the Brahmans, at the cost of the Vaisyas and Sudras.[13] Attention may be drawn in this connection to the alliance between the Brahmanas and the Ksatriyas for their mutual benefit. This can best be illustrated by the performances of royal sacrifices like the Rajasuya, Vajapeya and Asvamedha which signified growth of royal power and at the same time greater influence of rituals and their organizers in social and even political life.[14] [We must not forget, however, that the literary data in our possession for understanding this period are the products of the Brahminical priests who naturally did their best to glorify their political importance. How far this actually corresponded to reality is a different question. What seems most plausible is that the royal power found the Brahmanas as convenient ideological apologists for itself. This makes the Brahmanas secondary in importance compared to the Ksatriyas—note added by D.C.]

Interestingly enough, iron which appeared for the first time during this period seems to have been used at the initial stage for military purposes. Excavations at several sites included within the erstwhile kingdoms of Kuru, Pancala, Matsya, Madra and particularly at the archaeological site at Atranjikhera have yielded

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iron, figures in the *Rgveda,* it is difficult to prove the existence of iron tools, on the basis of archaeological findings, prior to B.C. 1000. N.R. Banerjee, *The Iron Age in India,* Delhi, 1965, considers the beginning of iron as early as 1000 B.C. which became more frequent around 800 B.C. Excavations at Noh and Jodhpura (Rajasthan), at Bhagawanpura and Dadheri (Haryana), at Atranjikhera, Lal Qila, Jakhera (U.P.) yielded Painted Grey Wares and "fairly commonly" iron during the period of 900-500 B.C. See Bridget and Raymond Allchin, *op. cit.,* 318.

[13] *The Aitareya Brahmana,* one of the major texts of the Later Vedic times, shows that the Vaisya could be evicted at will (*yatha-kama utthapya*), oppressed by others at will (*yatha-kama presya*—VIII.29.4) and the Sudra could even be put to death at will (*yathakamavadhya*).

[14] For a general description of these royal sacrifices, see U.N. Ghoshal, *A History of Indian Political Ideas,* Bombay, 1959, and H.C. Raychaudhuri, *Political History of Ancient India,* Calcutta, 1972, 145-54.

profuse iron weapons.[15] This may amply demonstrate the improvement in the military technology which in its turn intensified the coercive authority of the ruler and facilitated extraction of agricultural surplus. Under such circumstances, it may be reasonably presumed that growth of secular power would gradually relegate the importance of rituals and religious performances as a means of social and political control. Judged in this light, the growth of military technology would pave the way for the emergence of a standing army and as a result a process of secularization of the political and social life would begin.

The impact of these changes was clearly visible with the arrival of the early historical period from the sixth century B.C. onwards. The rise of *mahajanapadas* not only coincided with the rise of protestant religions like Buddhism and Jainism, but also lessened the importance of the priestly community in statecraft. The early historical period had the potential to question the ritual supremacy of the religieux and emphasize on the material basis of life. This could be amply demonstrated by the Kautiliyan idea of the elements (*prakrti*) of the state:[16] there one does not encounter the priest or the *purohita* in the list of elements of the state, (the *purohita*, however, is included by Kautilya in the list of the highest paid officers of the realm.)

The above discussion may drive home the fact that at the turn of the sixth century B.C. there was an overall challenge against the old orthodoxy in the air. Judged from this angle, one may appreciate that fresh grounds were being broken in almost all walks of life.

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[15] Earliest iron artefacts, more or less coeval with PGW, mainly comprise of spearheads, arrowheads, hooks etc. These were mainly meant for warfare—both offensive and defensive purposes. The use of furnaces and hearths provided with bellows is reported from the excavation at Suneri (Jhunjhunu *Dt.* Rajasthan). See R.S. Sharma, *Material Culture and Social Formations in Ancient India*, New Delhi, 1983, 59 [hereafter *Material Culture*]. For Iron artefacts unearthed from Atranjikhera, vide R.C. Gaur, *Excavations at Atranjikhera*, Delhi, 1983.

[16] *Kautiliya Arthasastra*, VI.1 (abbreviated hereafter *KAS*), The seven limbs (*angas*) or elements (*prakrtis*) of the state are enumerated as follows : (1) *Svami* (king/head of the state), (2) *Amatya* (bureaucracy, including ministers), (3) *janapada* (populated territory) (4) *durga* (fortified towns including the capital city), (5) *kosa* (treasury), (6) *Bala/Danda* (standing army), and (7) *Mitra* (ally). The limbs are enumerated according to their graded importance in the body politic.

The renewed emergence of cities is to be studied in the background of this changing situation and the challenge against orthodoxy. Cities of the early historical period are not to be regarded as a loose agglomeration of traits (i.e. exchange and administrative centres), but should be viewed as manifestation of a process which transformed the society from a more or less egalitarian phase into a sharply class-differentiated one. The historian doubtless faces an uphill task, but is on a relatively surer ground as the chronological framework is at present reasonably clear. The proverbial paucity of data which plagues any student of early Indian history is somewhat less. Diverse types of evidence—literary (indigenous, foreign, popular, theological and theoretical literature), epigraphic, numismatic and archaeological (mainly stratified evidence from excavations)—can profitably be used for the study of the socio-economic conditions during the period of nine hundred years of our study.

II

As the scene opens in about 600 B.C. the geographical focus is on the middle Ganga valley which seems to have relegated the importance of the upper Ganga valley and the parts of the Punjab (the area known as Brahmavartta/Brahmarsidesa lying between the Sarasvati and Drsadvati rivers). The *Anguttara Nikaya* enumerates sixteen territorial powers (*mahajanapadas*) embracing a region from Gandhara in the north to Asmaka in the south and from Avanti in the west to Anga in the east.[17] The visibly greater

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17. The term *janapada* literally means 'feet of the tribe'. Actually it denotes a territorial state as distinct from a lineage-based polity. The *Anguttaranikaya* (IV. 252, 256, 260) enlists sixteen such territorial states (*mahajanapadas*): (1) Kasi (mod. : Banaras), (2) Kosala (Lucknow-Gonda-Faizabad area), (3) Anga (Bhagalpur region, eastern Bihar), (4) Magadha (Patna-Gaya region, Southern Bihar), (5) Vajji/Vrji (area around Vaisali, north Bihar), (6) Malla (ancient capital Pava in northern U.P.), (7) Cedi (eastern part of modern Bundelkhand, ancient capital Suktimati), (8) Vatsa (area around Allahabad, in U.P.) (9) Kuru (near modern Delhi), (10) Pancala (Rohilakhand

concentration of *mahajanapadas* in the middle Ganga basin, i.e. in modern eastern U.P. and Bihar would unmistakably point this region as the 'area of attraction'.[18] Significant and prosperous human settlements were not necessarily confined to the area termed as *sistadesa* in the sacerdotal Brahmanical literature. In fact expansion of settlements from the Punjab area to the east, south and south-east had begun since *c.* 1000 B.C. The enlarging geographical horizon of the Later Vedic literature and the distribution of the Painted Grey Ware sites (which are more or less coeval with the Later Vedic literature) amply demonstrate the process of gradual penetration into the Ganga valley by people from the Punjab.[19] This movement of people not merely signalled change of habitat, but was linked up with the transformation of the pastoral life of the Rgvedic period (*c.* 1500-1000 B.C.) into a fully sedentary agricultural society of the Later Vedic times (*c.* 1000-600 B.C.)[20]

and central Doab), (11) Matsya (near Jaipur, Rajasthan), (12) Surasena (area around Mathura in U.P.), (13) Assaka/Asmaka (on the banks of the river Godavari), (14) Avanti (area around Ujjayini, M.P.) (15) Gandhara (Taxila-Peshawar, Rawalpindi area, Pakistan) and (16) Kamboja (Hazara *dt.*, Pakistan).

18. For the connotation of this term, See B. Subbarao, The *Personality of India*, Baroda, 1958, 85-106.
19. The *Aitareya Brahmana* (VIII. 14) was aware of no less than five principal regions, east, west, north, south and the central quarters. The central quarter, called *Dhruva-madhyamapratisthadis* (from which later emerged the more common term *Madhyadesa*) was situated in the upper Ganga valley and considered as the land per excellence. This clearly indicates an increasing awareness of the geographical horizon of the Vedic people whose principal habitat had definitely shifted from their erstwhile settlement in the land watered by the river Indus, the Sarasvati and the tributaries of the Indus (i.e. the area known as *Saptasindhava* in the *Rgveda*).
20. The *Rgveda* contains more references to cattle rearing and cattle wealth than to agriculture. The term *go* literally meaning cow or cattle stands for wealth (*rayi*) and a wealthy man is called *gomat* (lit. possessing cattle wealth) in the *Rgveda*. Even the term for war in the *Rgveda* is *gavisti* (literally meaning desire for cattle). There are, of course, some references to agriculture, but most of these are found in the interpolated sections of the text (e.g. Mandala X of the *Rgveda*). The *Rgveda* at best speaks of the process of transition from pastoralism to sedentary agriculture. See R.S. Sharma, *Perspectives in the Social and Economic History of Early India*, Delhi, 1983, 110-

The impact of this process was effectively felt from 600 B.C. onwards when large number of agrarian settlements emerged in the middle Ganga basin. It has been suggested that the regular use of iron tools (from *c.* 800/750 B.C. onwards) held the key to the successful clearance of dense forests of the Gangetic valley by widespread tree felling.[21] The area, one of the most fertile tracts of the subcontinent due to profuse rainfall and presence of life-giving streams from the Himalayan glaciers, began to be regularly exploited for agriculture.

The most suitable crop was of course rice which had appeared during the later Vedic period.[22] R.S. Sharma suggests that transplantation of paddy begun from *c.* 600 B.C. which definitely improved production of rice ; a new variety of rice namely *sali* also emerged in this period.[23] Interestingly enough, Trevor Ling points to the distinct possibility of higher fertility rate in rice-eating areas like the middle Ganga valley.[24]

Apart from rice, sugar and cotton figured among cultivated crops. Cultivation of these two cash crops, as distinct from cereals, clearly points to agrarian development.

The most tangible proof of the growth of settlement in the riparian tracts of the Ganga Valley is provided by archaeological evidence of a new kind of ceramic tradition, viz. Northern Black Polished Ware (NBPW).[25] This new pottery type is subsequent to and technologically more advanced than the Painted Grey

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114 (hereafter *Perspectives*), Ranabir Chakravarti, *Warfare for Wealth* : *Early Indian Perspective*, Calcutta, 1986, 7-25.

[21] Iron tools like axes and adzes seem to have been used for tree-felling. Deforestation could also have been possible by burning the dense forest, in the Ganga Valley. The story of Videgha Mathava in the *Satapatha Brahmana* (i.4.1.14-17) may indicate such a process. Mathava undertook a journey from the banks of the Sarasvati in the west to that of the Sadanira in the east (i.e. in Mithila or Videha region in north Bihar) with the sacred fire in his hand. The account probably symbolizes Brahmanical expansion from the upper to the middle Ganga valley after having cleared the dense forest in the Ganga valley by burning.

[22] The term for rice is *vrihi* which is not found in the *Rgveda*.

[23] *Perspectives,* 122.

[24] Trevor Ling, *The Buddha,* London, 1973, 42-43.

[25] Bridget and Raymond Allchin, *op. cit.,* 319-20, 323-24.

Ware. The chronological position of thePBEM is now fairly clear (*c.* 600-100 B.C.). Though the NBPW is unearthed from some sites in the upper Ganga basin like Ropar and Ahicchatra and even beyond the Ganga valley in Ujjayini, the heaviest concentration of the NBPW sites is in the middle Ganga basin. The alluvial tracts on the southern as well as northern side of the Ganga have yielded around 450 NBPW sites between Allahabad (the region represented by the *mahajanapada* of Vatsa) and Bhagalpur (the region represented by the *mahajanapada* of Anga).[26] This is precisely the area where existed three of the four principal monarchical powers, viz. Vatsa, Kosala and Magadha. Available literary sources are replete with references to agricultural operations and particularly iron ploughshares. It has been suggested that iron was probably used with increasing regularity for ploughing, because the heavier and thicker alluvial soil of the middle Ganga valley could be ploughed much more effectively with an iron share than by one made of copper, the latter being suitable for light, loamy type of soil in the upper Ganga valley.[27]

Archaeologically however, only two iron ploughshares have been found from NBPW phases at Kausambi and Vaisali[28] (in the later phase of NBPW). Nevertheless, archaeological evidence may point to the presence of more iron tools for production than those unearthed from the earlier PGW phase. Though the extent of the use of iron tools in cultivation and the impact of iron technology on agriculture in general are as yet not fully ascertained, it is quite likely that the alluvial tracts of the middle Ganga basin considerably helped enrich the agrarian economy. Early Pali cononical texts occasionally refer to *gahapati*-s, a term originally

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26. Bridget and Raymond Allchin, *op. cit.*
27. It is not unlikely that due to this heavier and thicker alluvial soil in the middle Ganga valley, four, six, eight, sixteen and sometimes even twenty-four oxen were attached to the plough. See *Maitrayani*, *Kathaka Samhita*-s and *Pancavimsa Brahmana*.
28. R.S. Sharma, *Material Culture*, 95, 112n. Panini knew iron ploughshares as *ayovikara kusi* (IV. 1.42). The *Suttanipata* calls it *phala* (*Kokalika Sutta*) while a later Pali synonym for the same was *ayonangala* (T.W. Rhys Davids and William Stede, *Pali English Dictionary*, London, 1921).

meaning a householder or head of the family, but denoting in the sixth-fifth centuries B.C. an agriculturist/peasant.[29]

According to the *Baudhayana Dharmasutra*, assignable to *c*. fifth century B.C. an arable plot, ideally suitable to maintain a family, should measure five *nivartana*-s.[30] On the other hand, estates as large as 500-1000 *karisa*-s, also figure in early Pali texts ;[31] these are apparently too big to be cultivated by the peasant himself, and therefore slave labour and hired labour are employed to till such bigger plots.

As success in agriculture in India was, as it still continues to be in modern times, a virtual gamble with monsoon, the agarian community had to depend on irrigation projects. The middle Ganga valley, endowed with reasonably regular amount of annual rainfall and perennial rivers of glacial origin, appears to have been relatively less dependent on irrigation. The *Kunala Jataka*, probably preserving an earlier tradition, narrates an impending clash between two republican clans, the Sakyas and Koliyas, over the first use of the water of the river Rohini to irrigate their respactive fields.[32] The story underlines the importance of irrigation in the middle Ganga valley.

Development in agriculture seems to have been beneficial for the rise of crafts and various other occupations. The Later Vedic literature, particularly the *Yajurveda* contains some information on the rise in the number of crafts.[33] But it is in the early Pali canoncial texts (e.g. *Vinaya Pitaka,* the first four *Nikayas* of *Suttapitaka*, viz. *Digha*, *Majjhima*, *Samyutta* and *Anguttara Nikayas* and the *Suttanipata*) that an unmistakable proliferation of crafts is clearly seen. Weavers, carpenters (*vaddhakis*), smiths (*kammaras*), leather workers (*cammakaras*) are repeatedly mentioned in these sources. Along with these crafts catering mainly to daily necessities, mention may be made of ivory work which is

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29. The term *gahapati* (Skt. *Grhapati*) not only meant an agriculturist householder, but also in later times was used as a status symbol in association with a very rich person, often a merchant. See Narendra Wagle, *Society at the Time of the Buddha*, Bombay, 1966.
30. *Perspectives,* 123.
31. *ibid,* 123.
32. *Jataka* no. 523.
33. A large number of crafts are mentioned in the description of Purusamedha sacrifice in the *Yajurveda*.

of course a luxury item meant for moneyed people. Two of the most significant crafts were iron works and pottery. Iron objects are found in considerable number from sites in U.P. e.g. Kausambi, Prahladpur, Banaras, and Mason and in Bihar e.g. Chirand, Vaisali, Patna, Sonpur and Champa.

These include axes, adzes, knives, razors, nails, sickles, many of them being intimately associated with agricultural operations. The definite improvement in iron tools in this period must have been due to the easy access to the richest iron ore deposits in south Bihar area. Some iron artifacts of NBPW phase from Banaras are found to have contained the same impurities as noticed in the iron ores of Singhbhum and Mayurbhanj. This goes to show the importance of iron mines of south Bihar and adjoining areas giving greater fillip to the growth of iron-based industrial activities.

Another significant development in the craft economy was the beginning of organization of industries under the names *sreni*, *gana*, *puga*, *samgha*, all loosely translated as guild. These terms occur in Panini's *Astadhyayi*[34] and early Buddhist canons. To what extent guild organization became an integral part of craft economy cannot be ascertained at the present state of our knowledge. But the *Gautama Dharmasutra* not only speaks of professional organizations among cultivators, traders, money-lenders and artisans, but also allows them to "lay down rules for their respective classes".[35] This implies gradual evolution of guild laws which would control and guide activities of these professional bodies.

A well-established agrarian base sustaining diverse types of craftsmen also encouraged exchange of commodities. The *Astadhyayi* of Panini was aware of the essential elements in trade, viz. *Krayavikraya* i.e. purchase and sale.[36] The same text would also suggest differentiation among merchants on the basis of commodities they dealt in and also areas they hailed from.[37] Early Pali texts highlight the position of rich merchants (*setthis*) with traditionally eighty crores of wealth (*asiti kotivibhava*) and of caravan traders (*satthavahas*) often driving large number of wagons from the eastern limit to the western limit (*pubbanta-aparanta*). A typical representative of the new rich community of merchants can be seen in the *sresthi* of Sravasti, Anathapindika. Though regular exchange networks had arrived at the middle Ganga valley by the Later Vedic period, commerce began to be definitely linked up with a flourishing money economy from the 6th century B.C. onwards. The earliest coins of India, viz. punch-marked silver species, began to be circulated throughout the Ganga valley and tended to spread beyond it.[38] It is rather unlikely that these coins were struck by existing political authorities, but by different merchant groups.

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[34] V.S. Agrawala, *India as known to Panini*, Lucknow, 1953.

[35] *Gautama Dharmasutra* XI. 21.

[36] V.S. Agrawala, *op. cit.*

[37] V.S. Agrawala, *op. cit., asva-vanija, go-vanija, Madra-vanija, Kasmira-vanija and Gandhari-vanija.*

As a flourishing economy was spreading over greater parts of north India, political consolidation can also be noticed in the shape of rise of four major monarchical powers (Kosala, Vatsa, Avanti and Magadha) and one non-monarchical clan (the Licchavis), thereby reducing the previous number of rival political powers from sixteen to five. The ensuing struggles for supremacy among these five ultimately paved the way for political paramountcy of Magadha in north India.[39] The need of the hour was the creation of a well-exercised, regularly paid and properly maintained standing army. Such a permanent armed force, distinct from militia forces of pre-600 B.C. times, could best be maintained by a regular system of appropriation of surplus. Political developments of this period show a definite inclination towards greater concentration of coercive powers in the hands of the king who was now in a position to claim various levies from agrarian, industrial and commercial activities. A king of Kasi is described in the *Mahavagga* as very wealthy and with a full treasury and storehouse (*mahaddhano paripunna kosakotthagala*).[40]. Similarly the *Suttanipata* states that Kosala was rich in vigour and prosperity (*dhanaviriyena sampanna*).[41] While Bimbisara had under him a large number of royal officers,[42] early Pali canoncial texts refer to settlement officers (*rajjugahakamaccas*) who were definitely associated with revenue assessment and collection. Extraction of the agrarian surplus held the key to the growth of political power of rulers and also to the process of urbanism which will be discussed below.

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[38] Punch-marked coins which are the archaeologically earliest metallic medium of exchange in India are found over greater parts of the subcontinent. Early punch-marked coins are, however, found from the middle Ganga valley which emerged as the most important region in the subcontinent during the period from the 6th century B.C. to the 2nd century B.C. See, P.L. Gupta, 'A Bibliography of the Punch-marked Coins of Ancient India', *JNSI, XVII,* 1, 1955.

[39] Ranabir Chakravarti, *op. cit.,* 26-76.

[40] *Mahavagga,* X, 2, 3.

This now brings us to the process of urbanization which reappeared in Indian scene almost after a millennium since the decline of the Harappan towns. Available literary sources are full of descriptions of towns and cities, numbering sometimes as much as sixty. This is in strong contrast to literary evidence of earlier periods which rarely referred to cities. Of outstanding cities belonging to the early phase of the Second Urbanization were six, viz. Campa, Rajagaha, Saketa, Varanasi, Kausambi and Kusinara.

They are usually depicted as having huge ramparts, moats, gateways, lofty palaces, busy streets full of merchants and artisans and royal residences. The descriptions are often stereotyped and to be taken with a grain of salt.[43] All these six cities are intimately associated with the life and activities of the Buddha. The Buddha and his followers repeatedly emphasized upon their preference for *dana* (gift) to *samgha* to *daksina* (sacrificial fees for priests). The concept of gift of alms fits in well into an urban milieu than a rural surrounding, as townsmen with more surplus at their disposal were in a position to patronize Buddhists more effectively. This should be appreciated in the background of the well-known support of the trading community to the *samgha*.

Many of the urban sites, including the six major ones, are excavated, and literary data may therefore be compared with the archaeological. The major problem here is that most of early historical urban sites were vertically excavated, mainly with a view to determining their chronology. But only regular horizontal diggings could really unravel the structure, layout and life in such urban centres. At Atranjikhera the PGW layer spread over

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[41] *Suttanipata, Pavajjasutta.*

[42] According to Buddhist tradition Bimbisara had under him no less than 80,000 villages and their respective headmen (*gramikas*), *PHAI*, 208.

[43] The doubt about the actuality of the literary descriptions of early historical towns has rightly been raised by A. Ghosh, *op. cit.*

650 sq. meter, while the succeeding stratum of NBPW measured 850m×550m.[44] This indicates growth of the site and demographic increase. One may infer breaking of new grounds in the site concerned which almost assumed urban dimensions. One of the most distinctive features of an urban site, namely fortification wall, has also been unearthed from excavations. The most enormous fortification wall is reported from the Kausambi excavation (circuit over 6½ k.m.).[45] The fortification wall, according to G.R. Sharma, the excavator, was erected in *c.* 1000 B.C. This is considered to be too high an overdating by A. Ghosh who, however, assigns it a date prior to the arrival of NBPW.[46] Pre-NBPW fortifications were raised at Eran, Ujjayini and Rajghat (Varanasi). In Eran and Ujjayini imposing fortifications of mud bricks were erected in 700 B.C. and 750 B.C.[47] The huge mud rampart at Rajghat is placed around 600 B.C.[48] A stone fortification also protected the urban site of Rajagrha (over a circuit of 40 k.m.), which is traditionally associated with Magadhan rulers Bimbisara and Ajatasatru.[49] While these fortifications were built in or before 600 B.C., other urban centres had their fortifications subsequently, between 400 and 200 B.C.

Though excavated materials do not admittedly tally with the glorified account of cities in Buddhist texts, one has to take into serious consideration the emergence of a large number of non-rural settlements where people earned their livelihood by various professions other than cultivation. Many of these sites were either situated on navigable rivers or at points of convergence of overland routes. Several urban sites were simultaneously craft and commercial centres and also political headquarters of *mahajanapadas*. The presence of a newly moneyed class can be inferred

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44. A. Ghosh, *op. cit.*, 60.
45. G.R. Sharma, *Excavations at Kausambi, 1959, MASI*, 74, 1969.
46. A. Ghosh, *op. cit.*, 11.
47. *IAR*, 1956-57, 24.
48. A.K. Narain and T.N. Roy, *The Excavations at Rajghat*, Benares, 1976, also *IAR*, 1960-61, 37.
49. Ancient Rajagrha, present Rajgir, was the capital of Magadha prior to the rise of Pataliputra. Being surrounded by five hills, it is naturally fortified. See Muhammad Hamid Qureshi, *A Visit to Rajgir* (revised by A. Ghosh), Delhi, 1939; also A. Ghosh, 'Rajgir, 1950' *AI*, VII, 1951, 66-78.

from the use of a deluxe black polished pottery which appears to have been beyond the reach of ordinary persons. Excavations at Sravasti (period I, 600-300 B.C.) yield beads of precious and semiprecious stones.[50] Apart from the fairly high degree of manufacturing skill which sustained such a craft, it also presupposes the existence of an urbane rich community which required such luxury items.

The picture of a burgeoning economy and the beginning of urbanization in the Ganga valley is more or less agreed by historians. But there are sharp differences of opinion regarding the key factor behind urbanization. The role of social surplus without which the city can hardly exist is rightly stressed. R.S. Sharma underlines the major change in production process, mainly due to the advent of iron technology in agriculture and crafts. According to Sharma, regular use of iron implements helped clear the dense forest and till the heavy alluvial soil. The resultant agrarian surplus was then appropriated by political authorities who were rapidly growing their power. This 'surplus' played a vital role in the emergence of non-rural settlements functioning as manufacturing, commercial and political centres. Sharma thus highlights the role of technology in bringing about socio-economic changes of far reaching consequences.[51] This view is countered by A. Ghosh[52] and George Erdosy[53] who give priority to the social need/political demand for surplus rather than to the capacity to produce the surplus as a result of technological innovations. In other words they argue in favour of the greater role of a power structure (here in the shape of political authorities of the *mahajanapadas*) without which a surplus could not appear the moment it is asked for.

It is not easy at the present state of our research to indicate which factor—technological change or rise of a power structure—

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50. K.K. Sinha, *Excavations at Sravasti, 1959,* Varanasi, 1969.
51. R.S. Sharma, 'Iron and Urbanization in the Ganga Basin', *IHR,* 1, 1974, 98-103, also R.S. Sharma, 'Material Background of the Origin of Buddhism', Mohit Sen and M.B. Rao (ed.), *Das Kapital Centenary Volume—A Symposium,* Delhi-Ahmedabad-Bombay, 1968.
52. A. Ghosh, *op. cit.,* ch. III, sec. 2,
53. George Erdosy, 'The Origin of Cities in the Ganges Valley', *JESHO,* XXVIII, 1, 1985, 294-325.

played a greater role in the emergence of cities in the Ganga valley. There would be, however, little hesitation to conclude that cities could hardly exist and prosper without the combination of the two.

The rapid survey in this section is admittedly confined to north India. A contrasting pattern is seen in the trans Vindhyan regions. Archaeological excavations/explorations have brought to light the practice of agriculture, presence of black and red ware, use of iron and megalithic burial customs in contemporary Deccan.[54] But no major urban settlement is reported from archaeological findings. Keeping with this development, absence of territorial powers in contemporary Deccan is also interesting. It is not unlikely that lineage-based polities held sway over the region in question. Social stratification was apparently less in the Deccan than in the north. All these seem to have precluded production and appropriation of a social surplus from agriculture and non-agrarian sources in spite of the prevalence of iron technology. The lack of an ongoing process of the emergence of a state structure probably thwarted the growth of urban centres in the Deccan. And this may go in favour of Ghosh's argument. The other important point is that despite the rise of various cities in the Ganga valley, Pataliputra stays in the background. In fact the greatest city of the ensuing centuries was only known as Pataligama and dubbed as a *putabhedana*[55] (literally, meaning a place where lids of merchandise were opened). The Buddha nevertheless prophesied its future greatness.[56] He seems to have rightly assessed the economic importance of a trade centre at the confluence of three rivers and with an extensive hinterland in the vast plains ; to this should be added the strategically better location of Pataligama than Rajagrha, particularly since the beginning of Magadha's territoral expansion during Bimbisara's and Ajatasatru's reigns.[57]

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[54] Bridget and Raymond Allchin, *op. cit.*, 325-46 ; also A.K. Narain (ed.), *Seminar on the Problem of Megaliths in India*, Varanasi, 1969.

[55] *Digha Nikaya*, II, 72 (ed.) T.W. Rhys Davids and J. Estlin Carpenter, London 1890-1911. The *Kautiliya Arthasastra* (II.3) uses the term *panya-puta-bhedana*, thereby making its commercial nature more explicit.

[56] *Digha Nikaya*, II, 72.

[57] Ranabir Chakravarti, *op. cit.*, 32-39.

III

The economic and political developments during the age of the Buddha resulted in the gradual dissolution of the near autarchic situation of pre-600 B.C. days. The developments, no doubt of great importance, were however essentially confined to north India. A pan-Indian situation could be visualized only since late fourth century B.C. with the establishment of the Maurya empire. The Mauryas ruled over a vast territory, extending from Afghanistan in the north to northern Karnataka in the south and from Kathiawad in the west to Kalinga in the east, due mainly to the aggressive designs of Candragupta Maurya and Asoka.[58] The maintenance of this vast territory could be effectively achieved by a huge standing army and a very substantial bureaucracy. The army and bureaucracy in their turn could smoothly function only if the ruling authority marshalled enough resources to maintain them. This was the need which prompted the arrival of a managerial state during the Maurya period. The Mauryas not merely founded a centralized state, but the imperial government participated in production and distribution of commodities, parallel to private enterprises.[59] The result was the creation of a tremendous expansion of the scope of state activities which were guided strongly by economic considerations. This would logically encourage strong, realistic and pragmatic views in the matters of statecraft. This is best exemplified by the *Kautiliya Arthasastra* which invariably champions the economic interests of the political authority.[60] Kautilya attaches foremost importance to material well-being, on which rests the ideals of religious practices and pleasures (*arthaiva pradhanam, arthamulam dharmakamaviti*).[61]

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[58] The extent of the Maurya empire can best be determined on the basis of the internal and external evidence of the edicts of Asoka. Asoka calls the territories within his empire *vijita, rajavisaya* etc. (i.e. conquered territory, royal domain), while those outside his empire—both within the subcontinent and beyond—were designated as *amta avijita* (unconquered frontiers). The Maurya empire included in it parts of Afganistan. This was possibly due to the cession of territories viz. Arachosia (Qandahar), Paropanisadae (Kabul) and Gedrosia (Southern Baluchistan) to Candragupta Maurya from Seleucus. That Asoka retained his hold over these areas in Afghanistan is unmistakably proved by his edicts found from Afghanistan. See B.N. Mukherjee, *Studies in the Aramaic Edicts of Asoka*, Calcutta, 1983. The vast territories of the Maurya empire were probably conquered by Candragupta Maurya and Asoka annexed Kalinga to it.

[59] *Perspectives*, 128-36, Romila Thapar, *Asoka and the Decline of the Mauryas*, London, 1961, ch. on social and economic conditions ; Ranavir Chakravarti, *op. cit.*, 49-60.

The key to the Maurya policy of state control of economy lies in the highly successful exploitation of the agrarian surplus. The Mauryas were the first political authority to have exercised control over both the Indus and the Ganga river systems which supported the major agrarian communities. The state appears to have under it extensive crown lands (*sita*) which were brought under constant supervision of the *Sitadhyaksa* (Director of Agriculture over crown lands).[62] Hired labourers were employed by the state to cultivate the crown land ; arrangements were there to provide the cultivator with cattle and other agricultural implements.[63]

But the most important policy was the one of creation of settlements (*janapadanivesa*) in areas where no agrarian villages existed before or there were previous settlements but now deserted (*bhuta-purvamabhutapurvam va*).[64] Kosambi suggested that Asoka probably carried away (*apavudha*) prisoners of war from Kalinga and settled them in new *janapadas*.[65] The untapped resources—particularly agricultural—of these *janapadas* had to be fully exploited and negligence to cultivate land in a newly settled area led to confiscation of the plot.[66] The *Arthasastra* prescribes the ruler to provide agricultural advance in the form of cash, cattle and seeds to new settlers.[67] This appears to have been a forerunner of modern agricultural loan provided by the state. The loan had to be paid back to the royal treasury, as otherwise the entire policy would be detrimental to the enrichment of the treasury (*kosopaghataka*).[68]

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[60] We have used here the critical edition of the *Kautiliya Arthasastra* edited by R.P. Kangle in three parts, Bombay, 1972. Though T.R. Trautman's statistical analysis of the text indicates that the *Arthasastra* assumed its present shape in 1st/2nd centuries A.D., the kernel of the text, namely Book II, has been assigned to the 3rd century B.C. and hence to the Maurya period.

[61] *KAS* I, 19, 35.

[62] *KAS*, II, 24.

[63] *KAS* II, 24.2-3. One of the most controversial topics of agrarian history of the Maurya period is the one concerning the ownership of land. Megasthenes and three later Classical authors (Arrian, Diodorus and Strabo who give excerpts of Megasthenes' *Indika*) tend to give us the impression that the Maurya ruler was the sole owner of all lands in the state and no private person was allowed to hold land. (See R.C. Majumdar, *The Classical Accounts of India*, Calcutta, 1960). The accounts of Diodorus and Strabo mention that cultivators tilled the land of the king on condition of paying respectively one fourth and three-fourths share of the produce. A study of early Indian land system would on the other hand indicate the existence of a distinct sense of individual ownership of land. Though the king owned vast stretches of crown land (*sita*), this did not go against the individual ownership of land. See U.N. Ghoshal, *The Agrarian System in Ancient India*, Calcutta, 1972 and G. Bongard Levin, *Mauryan India*, Delhi, 1985, 138-53.

The period also marks definite interests of the political authority in irrigation projects without which agriculture could hardly prosper in India. Megasthenes speaks of government officials, Agoranomoi, who looked after, among other things, sluice gates on rivers in order to ensure distribution of irrigational waters to tillers.[69] The most eloquent testimony to state initiative in irrigation is provided by the lake Sudarsana in Kathiawad. It was launched during Candragupta's reign ; Asoka not only maintained it but also 'decorated' it with conduits (*pranalibhiralamkrtam*) which definitely helped distribution of water to nearby arable areas.[70] The *Arthasastra*, as one expects, brings all irrigation projects (*setu*) under governmental supervision and recommends levy of irrigation cess (*udakabhaga*). The irrigation cess was not levied at a flat rate but according to the manner of procurement of water.[71] Besides this, Kautilya directs the *Sitadhyaksa* to install a rain-guage (*varsamanakudya*)[72] so that irrigation facilities could be provided to relatively dry and arid zones.

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[64] *KAS*, II, 1.1.

[65] D.D. Kosambi, *The Culture and Civilization of Ancient India in Historical Outline*, London, 1965, 149.

[66] *KAS*, II.1.10.

[67] *KAS*, II. 1. 13,114, 16.

[68] *KAS*, II. 1. 14, *kosopaghatakau varjayet*.

[69] Strabo, *Geographikon*, Book XV, 1, Sec. 50.

[70] D.C. Sircar, *Select Inscriptions Bearing on Indian History and Civilization*, I, Calcutta, 1965, 175-80 (hereafter *SI*).

[71] *KAS*, II, 24. 18 ; the rate of water-cess was $^1/_5$, if water was set in motion by own hands of cultivators ; $^1/_4$ if set by shoulder, $^1/_3$ when set flowing in channels by a mechanism (*srotoyantra*) and $^1/_4$ when lifted from rivers, lakes, tanks and wells.

In the fields of crafts and industries the intiative of the state is also clearly visible. The *Arthasastra* rightly emphasizes the role of mines and minerals over which state monopoly is claimed.[73] According to Kautilya, treasury emerges out of mines ; and the army is born out of treasury (*akaraprabhavah kosah, kosaddanda prajayate*).[74] The *Akaradhyaksa* along with a number of subordinate officers thoroughly supervises all the stages of mineral production, right from extraction of minerals from ores to sending them to appropriate royal manufactories (*karmantas*) and finally to the sale of metals through official channels.[75] It is significant that the southernmost headquarters of the Mauryas named Suvarnagiri was situated very near the famous Kolar gold fields. Allchin discovered traces of very old workings of gold and diamond fields in Karnataka and western Andhrapradesh. These, according to him, could possibly go back to the days of the Mauryas.[76] Magasthenes' accounts would suggest overall supervision of all industrial activities.[77] This is to some extent confirmed by the *Arthasastra* which discusses about state textile factories, breweries, arms manufactories and state manufacturing of standardized weights and measures.[78]

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[72] *KAS,* II, 5.7.

[73] *KAS,* II. 12.

[74] *KAS,* II. 12.37.

[75] B.C. Sen, *Economics in Kautilya,* Calcutta, 1967.

[76] F.R. Allchin, 'Upon the Antiquity of Gold Mining in Ancient India' *JESHO,* V. 1962, 195-216 ; F.R. Allchin, 'Antiquity of Gold Mining in the Gadag Region of Karnataka', M.S. Nagaraja Rao (ed.) *Madhu,* Delhi 1981, 81-82.

[77] The city commissioners (Astynomoi) of Pataliputra were divided into six boards each consisting of five members. The first board supervised everything regarding industrial arts. Classical authors also state that all artisans (comprising the fourth 'caste') had to pay taxes to the state, except the shipbuilders and armour-makers who were employed by the government.

[78] *KAS,* II. 18 (*Ayudhagaradhyaksa*—Superintendent of the armoury ; *KAS,* II. 19 (*Tulamanapautavam*—Standardization of weights and measures); II. 23 (*Sutradhyaksa*—Superintendent of yarns); II. 25 (*Suradhyaksa*—Controller of spirituous liquors).

The Mauryas showed lively interests in trade and commerce. The Astynomoi of Megasthenes maintained strict vigilance over activities of merchants.[79] The Mauryas are said to have maintained roads by providing them with distance signals.[80] This account of Megasthenes is strikingly confirmed by the evidence of a royal road (*karapathi*) in Laghman area in Afghanistan. Two Aramaic edicts of Asoka from Laghman which speak of this royal road also contain information about distance of several places from Laghman.[81] In the *Arthasastra* scheme of things, management of commerce is assigned to the Director of Trade (*Panyadhyksa*)[82] and Director of Market place (*Samsthadhyaksa*). The *Panyadhyaksa* arranges for the sale of commodities produced in royal farms and factories, and devises suitable policies to control distribution of commodities in the market.[83] The profit is fixed at 5% for indigenous traders and 10% for foreign merchants. Maintenance of a strict price line is considered to be one of the major functions of the *Panyadhyaksa*.[84] This officer is also in charge of trade abroad and is advised to send trade missions to foreign countries. The *Arthasastra* however categorically instructs him that he should go wherever there is profit and avoid absence of the same (*yatolabhastatogacchet, alabham parivarjayet*).[85]

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[79] This will be evident from a study of the functions of the Astynomoi, See Strabo, *Geographikon*, XV.1. Sec. 57.

[80] Megasthenes states that this was one of the functions of the Agoranomoi, officers in charge of the countryside. According to him, distance signals on highways were erected after every 10 stadia.

[81] The epigraphic evidence of a royal road during the Maurya period is also corroborated by the account of Eratosthenes (death in c. 255 B.C.) who spoke of a royal highway connecting Palimbothra (i.e. Pataliputra) with the northwestern borderland of the subcontinent. See B.N. Mukherjee, *Studies in the Aramaic Edicts of Asoka*, ch. I.

[82] *KAS*, II.16 and II.21-22. The term *Samsthadhyaksa* occure in IV. 2. 1.

[83] *KAS*, II. 16.1 and 4.

[84] *KAS*, IV. 2. 28. The passage is to be studied in the context of the general subject matter of the chapter concerned. This chapter is known as *Kantakasodhana*, literally purification of thorns (to the state). In this chapter one of the sections is *Vaidehakaraksana*, i.e. protection from (dishonest) traders. It implies that in the *Arthasastra* scheme of things a trader is viewed as a thron to the state. The merchant in the *Arthasastra* is simply called a *Vaidehaka* (an ordinary trader) and not given the prestigious epithet *Sresthi*.

The brief summary of the state-controlled economic activities may impress upon us the fact that the Mauryas were able to build up a remarkable resource base. To this should be added the revenue machinery of the Mauryas which was aimed at appropriating the surplus from almost every sphere of the economy. The *Arthasastra* shows that land revenue was by far the most important source of income, the usual rate being $^1/_6$ or $^1/_4$ of the produce. Besides *bhaga* (share), *bali* and *udakaghaga* were also imposed.[86] The government also levied various taxes on crafts and commerce. Moreover the *Arthasastra* prescribes very stringent measures for emergency financing.[87] All kinds of force and fraudalent practices are upheld by the theoretician to replenish the state treasuary facing financial stringency.

The ability of the Mauryas to extract the surplus from agriculture and other spheres of the economy and the growth of a truly imperial political structure with several political centres strewn over the subcontinent, provided further impetus to urban development.

The most important urban centre was of course Pataliputra, the Maurya capital. Megasthenes' accounts impress upon us the effective management of a large urban centre.[88] Apart from administrative interest in crafts and commerce of Pataliputra, Megasthenes reports about official supervision over foreigners (the presence of foreigners is hardly surprising in view of the Mauryas' intimate connexions with west Asian rulers) and population

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85. *KAS*, II. 16. 25.
86. U.N. Ghoshal, *Contributions to the Study of Hindu Revenue System*, Calcutta, 1972; that the Maurya state imposed both *bhaga* (share of the produce) and *bali* (an obligatory payment) is amply borne out by the Rummindei Pillar Inscription of Asoka.
87. *KAS*, V. 2.
88. Pataliputra, according to Megasthenes, was 90 stades (9½ miles) in length and 15 stades (1¾ miles) in breadth. It was surrounded by a moat and a fortification wall, the latter having 570 watch towers and 64 gates. See R.C. Majumdar, *The Classical Accounts*. The management of the municipal affairs was entrusted to the Astynomoi, divided into six boards, who jointly looked after ports, marts and temples also.

pattern.[89] The *Arthasastra* provides the first systematic theoretical discussions on urban layout. The text in question views the urban centre as a fortified site (*durga*) and differentiates between its habitational, administrative, and commercial sectors.[90] The importance of urban centres is amply borne out by the *Arthasastra* which not only emphasizes the revenue potentials of a city, but also includes it in the list of elements of the state.[91]

The Mauryas appear to have encouraged urban growth beyond the middle Ganga valley where urban sites had first flourished in *c.* 600 B.C. Thus the Bhir Mound at Taxila reveals stone houses in the city along with a road.[92] While no defence walls are seen in the ruins of Taxila and Puskalavati (present Charsadda), these appear in Sravasti (phase II)[93] and Ahichhatra (phase II).[94] A metalled road is reported from Kausambi assignable to *c.* 350 B.C.[95] A definitely planned urban lay-out is evident from excavations at Sisupalgarh in Orissa, which seems to have come into existence in *c.* 300 B.C.[96] Soakage jars at Kausambi and wide distribution of ring wells at various urban sites would point to

[89] The second of the six boards of city commissioners was entrusted with matters concerning foreigners at Pataliputra. In the event of their illness and death, information was sent out and their property taken care of and protected. The fourth board was in charge of what may be called a forerunner of modern census. Megasthanes explicitly states that the census was carried on with a view to preparing assessment of revenue.

[90] *KAS*, II. 4 for the urban layout, II. 36 for the recommendations on the management of municipal affairs.

[91] *Durga* or the fortified area is the fourth element of the state. It is significant that while discussing the functions of *Samahartta* (Collector General, II.6), *durga* or fortified areas (i.e. urban centres) is placed ahead of *rastra* (i.e. countryside) in the list of sources of revenue. While the sources of income from *durga* number twenty, those from *rastra* are thirteen (*KAS*, II. 6. 1-3).

[92] J. Marshall, *Taxila*, I, Cambridge, 1952, 92.

[93] K.K. Sinha, *op. cit.*

[94] A. Ghosh and K.C. Panigrahi, 'The Pottery of Ahichhatra', *AI*, 1, 1945, 38 and 39.

[95] G.R. Sharma, *Excavations at Kausambi*, 1949-50 (*MASI*, 74), 1969, 24-26. Also G.R. Sharma, *Excavations at Kausambi, the Defences and Syenaciti of Purusamedha*, Allahabad, 1960.

[96] B.B. Lal, 'Sisupalgarh 1948 : An Early Historical Fort in Eastern India', *AI*, 5, 1949, 62-105.

betterment in civic sewage and public drainage systems.[97] A new urban site that began to make its presence felt in the Doab was Mathura. This city in the erstwhile Surasena *mahajanapada* was looked down upon in the *Anguttara Nikaya* as dusty, with uneven grounds, infested with fierce dogs and even for dearth of alms.[98] The period between 400-200 B.C. not only witnessed mud fortifications around the city,[99] but also a flourishing textile industry.[100] Excavations at Sonkh point to a prosperous bead industry.[101] A very interesting development is the diversity in secular house-planning—square, oblong and even circular.[102] This leads us to infer about the varied tastes of builders and/or their financiers in the urban complex of Mathura. The changing character of Mathura can be appreciated from a passage in the *Mahabhasya* of Patanjali. The text recognizes the inhabitants of Mathura as more cultured than the citizens of Sankasya and Pataliputra (*Sankasyakebhyasca Pataliputrakebhyasca Mathura abhirupatara iti*).[103]

IV

The state-controlled economy of the Maurya period ended with the political collapse of the Maurya power (*c*. 187 B.C.). But the dynastic upheaval did not adversely affect the economy. A major change, however, occurred : private enterprise began to dominate the economic scene, in agriculture, crafts and commerce alike, replacing the state-managed economy of the Maurya period.

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[97] G.R. Sharma, *op. cit.*, 37-39. These soak wells and/or jars could have also been used for irrigation purposes. See *Perspectives*, 159. For the sewage system in Taxila (Bhir Mound) see J. Marshall, *Guide to Taxila*, Calcutta, 1951, 94.

[98] *Anguttara Nikaya*, pt. III. ccxx, 256,

[99] *IAR*, 1974-75, 49.

[100] *KAS*, II. 11. 115. Textile products of Mathura are mentioned here along with those of Aparanta, Kalinga, Kasi, Vanga, Vatsa, and Mahisa.

[101] H. Hartel, *Excavations at Sonkh*. See particularly the findings from levels 16-22, assignable to the Maurya period.

[102] H. Hartel, *op. cit.*, 72. The point has been discussed by B.N. Mukherjee, *Mathura and Its Society*, Calcutta, 1981, 104 (hereafter *MIS*).

[103] The *Mahabhasya* of Patanjali, ed. F. Kielhorn, Bombay, 1892-1909, V.3.57.

As is expected, the vast state farms under the control of the *sitadhyaksa* gave way to smaller agricultural holdings which came mostly under private proprietorship. The early legal literature, represented by the *Manusmrti*, the *Yajnavalkyasmrti* and the Santiparpan of the *Mahabharata* strongly uphold private ownership of land. This is clearly corroborated by epigraphic evidence of gift/sale of plots to religious groups and persons. Usabhadata (or Rsabhadatta), son-in-law of the western Ksatrapa ruler Nahapana had to purchase a plot of land from a Brahmana owner and then donated it to the Buddhist Sangha.[104] The incident leaves unmistakable evidence of private ownership in land and double transfer of a particular plot, first by sale and then by gift. The Mauryas seem to have carried to trans-Vindhyan India the pattern of agriculture, based on iron ploughshare and irrigation. Several new crops appear in the scene, along with the traditional ones. These include two major cash crops, cocoanut (grown for the first time in northern Konkan)[105] and pepper[106] (in the Malabar coast). Excavations from different sites indicate cultivation of wheat, rice, barley, millet and lentils. That the riparian tracts between the Godavari and Krishna became particularly prosperous for rice cultivation is borne out by the name Dhanyakataka (literally, rice bowl).

Considerable attention was paid to irrigation. Political authorities were probably more interested in launching and maintaining supra-local irrigation projects than having overall control over all hydraulic projects. The most famous example in this regard is undoubtedly the repair and renovation of the Sudarsana Lake by Rudradaman I.[107] This is closely matched by Cola king Karikala's attempts to prevent the Kaveri delta, the core area of the Colas, from flooding.[108] One of the most remarkable feats of hydraulic engineering is seen in the large brick-built storage tank unearthed from the excavation at Sringaverapura near Kausambi. This tank had two chambers of varying depth and was connected with the Ganga by a brick-built channel. Water from the Ganga was allowed to enter the deeper chamber first where sediments were deposited and then the cleaner water passed into the second chamber from the first through an interconnecting channel.[109] That hydraulic techniques had considerably improved in the early centuries of the Christian era will be evident from the epigraphic reference to hydraulic mechanics (*odayantrikas*)[110] and reference to water wheel with pot garland (*rahatta ghadiyas*) in the *Gathasaptasati*.[111]

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[104] Nasik inseription of Nahapana, *SI*, 169-70.

[105] Nasik inscription of Nahapana, yrs. 41, 42, 45 (*SI*, 165-66), speaks of plantation of no less than 8,000 seedlings of coconut trees (*sisunarigela mulani*) at a village named Cikhalapada (=Skt. Citkhalapadra) in Kapurahara (=Karpurahara; *ahara*=district). Similarly 3200 coconut trees were planted in village Nanamgola, Nasik inscription of Nahapana, *SI*. 169-70.

[106] The availability of pepper in Malabar is reported in the *Periplus of the Erythraean Sea* (section 56), and Pliny's *Natural History*.

[107] This reservoir, originally built by Candragupta Maurya and well maintained by Asoka, suffered a huge breach due to a terrible storm in the very first regnal year of Rudradaman I. It was repaired in a short time (*anatimahatakalena*) and required huge expenditure from

The most remarkable feature of economic life was, however, proliferation of crafts and expanding trade. The period under review yields for the first time epigraphic evidence of a large number of craftsmen who left their names, traces of their occupation and religious leanings in course of making donations to various religious groups and persons. Such records are particularly available from western Deccan caves, Buddhist sites of Bharhut and Sanchi and from Mathura.[112] Sifting through the epigraphic evidence one comes across carpenters (*vaddhaki*), bambooworkers

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the treasury of Rudradaman I (*svasmat kosat mahatadhanaughena*), Junagarh Rock Inscription of Rudradaman I, SE 72 (150 A.D.), *SI*, 175-80.

108. K.A. Nilakantha Sastri, *A History of South India*, Bombay, 1966.

109. B.B. Lal and K.N. Dikshit, 'Sringaverapura : A Key site for the Proto-History and Early History of the Central Ganga Valley', *Puratattva*, 10, 1978-79, 1-8 ; also B.B. Lal, 'A 2000 year old Feat of Hydraulic Engineering in India', *Archaeology*, 38.1, Jan-Feb, 1985, 48-53.

110. *Odayantrikas* or *Udakayantrikas*, i.e. hydraulic mechanics are referred to in the Nasik inscription of Abhira Isvarasena, *EI*, VIII, 82-83.

111. *The Gathasaptasati of Hala*, ed. and tr., R.G. Basak, Calcutta 1971, V. 90.

112. See *EI*, II, 79-116, K.L. Janert (ed.) H. Luders, *Mathura Inscriptions*, Gottingen, 1961 ; James Burgess and Bhagawanlal Indraji. *Inscriptions from the Cave Temples of Western India*, Archaeological Survey of Western India, X, 1881 (reprint, 1976) and 'LL', *EI*, X.

(*vasakara*), reed-makers (*konacika*), braziers (*kasakara*), potters (*kularika*), weavers (*kaulika*), perfumers (*gamdhika*), clothmakers (*pravarika*), oilmen (*tilapisaka*), garland makers (*malakara*), jewellers (*manikara*), ivory workers (*dantakara*), goldsmiths (*suvarnakara*), blacksmiths, (*lohikakaruka*). The list includes products of daily necessities and also luxury items. Most of the latter were urban crafts. Many of the above crafts and artisans are also mentioned in *Jataka* stories which are assigned by modern scholars to the early centuries of the Christian era.[113] One of the foremost industries must have been textile ; textile products flourished particularly in the Deccan obviously because of the facilities of cotton plantation in the black soil there. The *Periplus of the Erythraean Sea* (assignable to late 1st century A.D.) speaks of two active textile centres in Central Deccan, namely Tagara (Ter) and Paithan (Pratisthana, the Satavahana capital).[114] Excavations at Ter have yielded a number of vats for dyeing cloth[115] which seems to have confirmed the evidence of the *Periplus*. Similar dyeing vats are also reported from the excavations at Arikamedu (near Pondicherry, Tamilnadu).[116] One of the most famous textile products, viz. muslin, is repeatedly mentioned in the Classical accounts, and the *Periplus* considers muslin of the Gange country (in lower deltaic Bengal) as of the best and costliest type.[117]

Crafts production, like production in agrarian economy, is characterized in this phase by lessening control of the state and growing private enterprise. There was perhaps one sector in industrial production where the state authority seems to have retained its interests : it was mining industry. Legal literature of this period advocates royal monopoly over all mines and minerals. Epigraphic and literary materials, when studied along with the *Geographike Huphegesis* of Claudius Ptolemy (*c.* 150 A.D.), may indicate that the Kusanas took initiative to work out diamond mines in Eastern Malwa (variously called Dasarna, Akara, Purva Malava and Cosa).[118] These diamond mines later seem to have been controlled by Rudradaman I (150 A.D.).[119] The *Periplus* (also Ptolemy's *Geography*) mentions pearl fisheries in the Pandya kingdom of far south India.[120] These fisheries in the Kolchic Gulf (probably the Gulf of Mannar) were located at Kolchi (present Korkai, Dt. Tiruneveli, Tamilnadu) and were under monopoly control of the local Pandya rulers. The *Periplus* narrates that captives of war, awarded capital punishment, were used here as deep sea divers. While the procurement area was in Kolchi, pearls were distributed under government control only from Argarus (Uragapura of the Sangam literature and present Uraiyur in Dt. Tiruchirappalli, Tamilnadu).[121] Recent excavations at Korkai have brought to light remains of pearl oysters from various levels,[122] confirming thereby the description in the *Periplus*. Mining operations in early India also included salt manufacture. While theoretical treatises would advocate salt manufacture under royal control, epigraphic evidence, however, suggests prevalence of private enterprise in salt-making against the payment of a salt tax to the state. This is proved in a roundabout way by epigraphic references to remissions from salt tax (*alonakhatakam i.e. alavanakhadakam*) known from Satavahana records of the early centuries of the Christian era.[123] The *Naturalis Historia* of Pliny (dedicated to Titus, the son of Vespasian in A.D. 77) contains a significant passage in this connexion : referring to the practice of salt quarrying in Mt. Oromenus (Salt Range in Pakistan), the author says that political authorities derived greater revenue from salt mines than from even those of gold and pearls.[124] The importance of salt manufacture has been rightly assessed from the point of its revenue yielding potentials. We have stated at the outset that there was a lesser degree of state control on crafts and industries than that prevalent under the managerial state of the Mauryas. Political authorities, however, appear to have been interested in deriving levies out of industries and crafts mainly run by private enterprise. This is clearly illustrated by the imposition of levies on craftsmen (*karukara*) in the Satavahana territory.[125] In view of the steady growth of crafts and industries in the western and central Deccan during the period in question, the attempt of the Satavahana rulers at realizing revenue out of them sounds quite logical.

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[113] It is difficult to assign definite date of Jataka stories. Though some of the stories could have originated in a period prior to the Buddha, most of them are of later date. The Jatakas appear to have reflected the social condition of the period commonly known as the Saka-Kusana-Satavahana phase.

[114] *Periplus*, section 51.

[115] B.N. Chapekar, *Report on the Excavation at Ter, 1958*, Poona, 1969.

[116] R.E.M. Wheeler, 'Arikamedu : An Indo-Roman Trading Station on the East Coast of India', *AI*, 2, 1946, 17-24.

[117] *Periplus*, section 63. For the trade and urban centres of early Bengal, see Amita Ray, Presidential Address, Section I, Indian History Congress, Goa, 1987.

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[118] *Geograpike Huphegesis* of Ptolemy, tr. E. Stevenson, London, 1932, VII, 65. For a detailed discussion of this topic see B.N. Mukherjee, *The Economic Factors in Kushana History* (hereafter *EFKH*), Calcutta, 1970, and Ranabir Chakravarti, *op. cit.* 94-96.

[119] Rudradaman I is described as the lord of many areas including Akara, i.e. eastern (*purva*) part of Malwa which came under his possession after the heyday of the Kusanas. His treasury is said to have been overflowing with minerals, gems and precious objects including diamond (*vajra*), *SI*, I, 175-80. Also see B.N. Mukherjee, 'Revenue, Trade and Society in the Kushana Empire', *IHR*, VII, 1-2, July, 1980-Jan, 1981, 24-53.

[120] *Periplus*, section 58 ; *Geographike Huphegesis*, VII. 10.

[121] *Periplus*, sections 58-59.

[122] R. Nagaswamy, 'Excavations at Korkai', *Damilica*, I, 1970.

One of the salient features in industrial life was the growing importance of guilds (mostly called *srenis*). Almost every industrial activity and major profession were organized under their respective guilds. Large number of epigraphic documents from western, eastern and central Deccan, Central India and Mathura leave little room for doubt about their economic importance which is also clearly recognized in diverse literary sources, e.g. the *Jatakas*, *Avadanas*, *Milindapanho*, *Manusmrti*, *Yajnavalkyasmrti*, *Mahabharata*.[126] The legal literature throws valuable light on the cooperative character of these organizations and also on the guild laws. While early Buddhist literature knew of the members of a guild and their president/leader (*jetthaka*, *pamukha* etc.), legal literature of this period adds to it the executive officers (*karyacintakas*),[127] indicating thereby growing complexities and expanding functions of guilds.

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123. *SI*. 198-200, 208 ; also see D.C. Sircar, *Indian Epigraphical Glossary*, Delhi, 1969.
124. Pliny, XI. 11.1.
125. Karle Cave inscription of Vasisthiputra Pulumavi, *SI*, I, 202.
126. R.C. Majumdar, *Corporate Life in Ancient India*, 13 ff. A.N. Bose, *Social and Rural Economy of Northern India*, I, Calcutta, 1967.
127. R.C. Majumdar, *Corporate Life in Ancient India*, 36-37.

An eloquent testimony to the expanding scope of activities of guilds is seen in the new function of guilds as banks. Inscriptions from western, central and eastern Deccan and Mathura record a number of cases where guilds accepted permanent deposits of money (*aksayanivi*) on condition that the principal would be kept intact and only the interest would be utilized (*vrddhibhojyam*).[128] The guild thereby provided the vital capital to expanding craft activities. These guilds also played a vital role in contemporary trade network to which we shall come later.

This proliferation of crafts was equally matched by a trade boom from the first century B.C. onwards. The vast subcontinent provided a market large enough for consumption of growing agricultural and industrial commodities. But the most significant aspect of commercial activities of this period is the brisk participation of India in long distance international exchange network —both overland and maritime—particularly with the Roman empire.[129] The Roman empire had definite interests in commerce with the East which at the outset took the form of trade links with China. There was a great craze for Chinese silk in Roman market which was supplied with that commodity and other items along the famous overland Silk Road. However, the presence of the Parthians or Arcacids (An-hsi of early Chinese texts) of Iran as an unavoidable commercial and political intermediary between China in the east and Rome in the west created considerable obstacles for free flow of merchandise. There was a need for an alternative and less extortionate intermediary. This need was fulfilled by the foundation of the Central Asiatic empire of the Kusanas who extended their rule over vast territories of north

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128. Nasik inscription of Nahapana, yrs. 41, 42, 45, *SI*, 165-66.

129. There are many books and research papers on various aspects of Roman trade. See W.H. Warmington, *Commerce between India and the Roman Empire*, Delhi, 1974, M.I. Rostovsev, *The Social and Economic History of the Roman Empire*, Oxford, 1957 (in 2 volumes), R.E.M. Wheeler, *Rome beyond the Imperial Frontiers*, London, 1954 ; U.N. Ghoshal, 'Economic Conditions' in K.A. Nilakantha Sastri (ed), *The Comprehensive History of India*, II, Bombay, 1957, and L. Bulnois, *The Silk Road* (London, 1967). The most exhaustive bibliography on this topic is available in M.G. Raschke, 'New Studies in Roman Commerce with the East', *Aufstieg und Niedergang der Romischer Welt*, IX, Berlin, 1978.

India including the Indus delta and Kathiawad peninsula (first century A.D.).[130]

To this period is also assigned the discovery of south-western monsoon winds and its increasing utilization in high sea trade between India and Rome via the Red Sea.[131]

The *Periplus* (section 64) describes how Chinese silk trade was diverted through Bactria to Kabul area and from there to Peshawar-Rawalpindi area, and thence to Mathura in Ganga-Jamuna doab.[132] From Mathura merchandise was brought to Barygaza, the most important port on western sea board of India,[133] via Sanchi and Ujjayini.

The silk was shipped to Rome from Barygaza. The *Periplus*, Ptolemy's *Geography*, Pliny's *Natural History*, Strabo's Geography—all unequivovally refer to the very prosperous and brisk Indo-Roman trade. Pliny discusses the gradual development of the sea routes in four stages, the latest and most developed phase of which brought a ship from a Red Sea Port to Muziris (Cannanore) in the Cera country, the most important port in Malabar, within forty days.[134] Strabo noted (in *c.* 19 B.C.) that previously only four or five ships undertook voyages to India ; but during the reign of Augustus no less than 120 ships sailed to Indian ports annually from Alexandria.[135]

The two sea boards of India, particularly the western sea-board, were dotted with a number of ports and harbours. The outstanding ports were Barygaza, Muziris[136] on the west coast and Khaberos and Poduca on the east coast.[137] Some ports have been termed *emporion* by Ptolemy. The term *emporion* is used by Ptolemy in a very restricted sense. It seems to have denoted "an oriental

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130. B.N. Mukherjee, *Rise and Fall of the Kushana Empire* (hereafter *RFKE*), Calcutta, 1988.
131. The discovery of the southwest monsoon wind is generally ascribed to a Greek sailor, Hippalus, after whom the wind was often called the Hippalus wind. *Periplus,* section 57, Pliny, Book VI, 26.104. The discovery of the monsoon winds was one of epoch-making significance in the history of the Indian Ocean trade.
132. *Periplus,* sections 48, 64.
133. For a description of Barygaza, see *Periplus,* sections 43, 44, 49.
134. Pliny, VI. 26. 104 ; see Ranabir Chakravarti, *op. cit.,* 91-92,
135. Strabo, *Geographikon,* II. 5. 12.
136. *Periplus,* sections 54-57, Ptolemy VII. 8.
137. Ptolemy, VII, 13 and 14.

market town lying in or near the sea-coast and beyond the imperial frontiers of Rome. In such emporia permanent lodges of western traders were established definitely under formal agreements with appropriate Indian rulers".[138] Regular settlements of foreign merchants possibly grew up at Muziris (where a temple of Augustus was erected according to the *Tabula Beutengarariana*[139]) and at Poduca (as is evident from the excavations at Arikamedu), an Indo-Roman trading station near Pondicherry. All major political powers of the subcontinent, namely the Kusanas, Sakas, Satavahanas, Colas, Ceras and Pandyas are found to have actively encourged long-range trade in or through their respective territories.[140]

Several trade missions between the Roman emperor and Indian powers have been well-known to students of Indo-Roman trade, thanks to Warmington's researches.[141]

The most eloquent testimony of this trade is supplied by the presence of a considerable number of Roman coins in several hoards in India.[142] Most of such coins are found from south India, indicating that the area had closest commercial links with Rome. Roman coins were mostly used as bullion in India. The impact of trade on the currency system appears to have been considerable. Monetization was fairly extensive. Major powers like the Kusanas and Satavahanas expectedly had their impressive coinage[143]; but even non-monarachical clans also minted their own coins.[144] Another significant aspect of coinage was the availability of a large number of copper coinage (along with gold and silver coinage). As copper coins were generally utilized for daily transactions as against gold and silver coins, mainly used for international transactions in valuables, there was an impact of monetization even on the daily life of the common people.

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[138] B.N. Mukherjee, *EFKH*, 47.

[139] K. Miller, *Peutingerische Tafel*. Munich, 1962, Segment, XIII.

[140] Ranabir Chakravarti, *op. cit.*, 105-112.

[141] E.H. Warmington, *op. cit.*, 35 ff.

[142] R.S. Sharma, *Urban Decay in India*, 300-1000 A.D. Delhi, 1978, 136, says that there are 129 sites in India yielding Roman coins. His figure is based on the unpublished article of Mansfield G. Raschkey, 'Roman Coinfinds in the Indian Subcontinent : A Catalogue and Analysis' ; also see R.E.M. Wheeler, *My Archaeological Mission to India and Pakistan*, London, 1976, 38 for a map showing distribution of findspots of Roman coins in India.

[143] B.N. Mukherjee, *Kushana Coins in the Land of Five Rivers*, Calcutta, 1979 ; B.N. Mukherjee, *Kushana Silver Coinage*, Calcutta, 1982 ; A.M. Shastri (ed.), *The Coinage of the Satavahanas and Coins from Excavations*, Nagpur, 1972.

[144] K.K. Dasgupta, *A Tribal History of Ancient India, a Numismatic Approach*, Calcutta, 1976.

Under such circumstances it is hardly surprising to find merchants enjoying considerable eminence. Available literary and epigraphic materials are replete with names and activities of wealthy merchants (*setthis, gahapatis, rajasresthis*[145] or royal merchants). The merchants are often found to have been organized under commercial guilds (e.g. *vaniggrama* in a Karle inscription).[146] These occupational and commercial guilds are known to have maintained close links with religious establishments.[147] Himanshu P. Ray has effectively demonstrated the role played by the monastery and guild in the Satavahana territory in the expansion of commerce. The linkage patterns among mercantile guilds, Buddhist *samgha* and rulers have also been highlighted. Ray views monasteries of western Deccan "as pioneers and as centres providing information on cropping patterns, distant markets, organization of village settlements and trade. They also helped establish channels of communication in newly-colonized regions and those channels could then be used by the state to enforce its authority".[148]

The above survey of the economic condition of the period from *c.* second century B.C. to third century A.D. gives an impression that there was allround development in agriculture, trade and crafts. The development was not confined to the Ganga valley or north India, but spead more or less over the entire subcontinent though with varying patterns. The political scene also speaks of expansion of monarchical system over greater parts of the subcontinent. The rise of large empires under Kusanas and Satavahanas provided the required political structure without which economy could hardly prosper.

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[145] Richard Fick, *Social Organization of North-eastern India during the Buddha's Time*, Calcutta, 1920 ; A.N. Bose, *Social and Rural Economy of Northern India*, II, ch. I., Calcutta, 1967; for Rajasresthi see Ranabir Chakravarti, 'Rajasresthi', B.M. Pande and B.D. Chattopadhyaya (ed.), *Archaeology and History*, Delhi, 1987, vol. II, 671-78.

[146] Our attention to the mercantile organization named *vaniggrama* was first drawn by D.D. Kosambi, 'Dhenukakata', *JBBRAS*, xxx, 1955, 50-71. Activities of such a *vaniggrama* are found in an inscription of 592 A.D., see *E.I.*, XXX, 163-81. This organisation became particularly prominent in early medieval south India under the name Manigramam.

[147] Himanshu P. Ray, *Monastery and Guild : Commerce under the Satavahanas*, Delhi, 1986.

[148] Himanshu P. Ray, *ibid*, 89.

The economic and political climate seems to have paved the way for brisker rate of urban growth which reached its peak between the second centry B.C. and third century A.D. While urban centres in previous periods were mainly confined to northern Indian plains, they became in this period an all-India phenomenon. It will be quite impossible to do justice to the emergence and growth of urban centres all over the country within the relatively short space of this paper. Hence only some salient features may be highlighted here.

In Taxila, one of the foremost urban sites of the northwest, the excavations at Sirkap shows considerable growth from its previous stage represented by the materials in the Bhir mound. Founded by Indo-Greeks, Taxila (Sirkap) was extended and fortified by masonry wall by Indo-Parthian rulers. It was a fully planned city, with spinal streets spreading from the north gate to the entire length of the city. The main street was interlinked with smaller lanes and streets which met at right angles. Residential houses were laid out in a well-defined manner. Such planned urban centres are a novelty in the general Indian scene and the influence of foreigners is quite unmistakable.[149] A. Ghosh aptly remarked, "foreign in origin and conception, Sirkap is not a representative Indian city".[150] In Ahicchatra a concreted road was found from a layer assignable to about 200 A.D.[151] In north eastern Bihar Vaisali, the stronghold of the Licchavis witnessed three successive fortifications between the second century B.C. and second century A.D.[152] The Orissan urban complex at Sisupalgarh which has already figured in our discussion in a previous section underwent a process of elaboration. A massive mud rampart was raised in the phase ranging from 200-100 B.C. and this was later reinforced by brick reventments. The most impressive feature was, however, a magnificent gateway complex.[153] A remarkable growth is seen at Mathura which came under first Scytho-Parthian and later, Kusana rule. As both the powers had strong links with and orientations to northwest borderland of the subcontinent, Mathura became, as it were, a part of the northwest. Archaeological materials unearthed from levels 23 and 24 at Sonkh (assignable to Ksatrapa age) reveal that houses were irregularly placed and streets looked crooked in comparison to earlier periods. B.N. Mukherjee draws our attention to "the use of stone in the projected sections of buildings at street corners, probably to ensure protection against damages by vehicles".[154] This is rightly interpreted as a sign of increase in the volume of traffic and consequently that of merchandise and traders. This was followed by the seven levels of Kusana occupation at Sonkh.

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[149] J. Marshall, *Taxila*, I.

[150] A. Ghosh, *op. cit.*, 61.

[151] A. Ghosh, *op. cit.*, 62.

[152] B.P. Sinha and Sita Ram Roy, *Vaisali Excavations*, 1958-62, Patna, 1969, 5-6.

The ground plan of level 16 shows the most systematic and developed phase of urban layout.[155] Residential houses were build not only of mud bricks but also burnt bricks. Fortifications at Mathura were revived, enlarged, and repaired. An inner mud enclosure or fortification of smaller size was raised, which seems to have provided security to the administrative headquarters.[156] One may remember that Mathura emerged as one of the political centres of the Kusana empire.[157] The city of Mathura, which was an object of scorn and hatred in the *Anguttaranikaya*, a Buddhist source of *c*. fourth century B.C., is eulogized in the *Lalitavistara*, another Buddhit text of *c*. third century A.D. as prosperous, large, beneficial, with easy availability of alms and abounding in population (*iyam Mathura nagari rddha ca sphita ca ksema ca subhiksa cakirna bahujanamanusya ca*).[158]

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[153] B.B. Lal, op. cit. *AI*, 5, 1949, 62-105.
[154] B.N. Mukherjee, *MIS*, 116.
[155] B.N. Mukherjee, *MIS*, 116.
[156] B.N. Mukherjee, *MIS*, 118.
[157] B.N. Mukherjee, *RFKE*.
[158] *Lalitavistara*, ed. P.L. Vaidya, ch. 2, p. 15.

Several urban sites are reported from the western and central Deccan of which Nevasa,[159] Ter and Satanikota[160] are of outstanding importance. A few words may here be said about Satanikota. This fortified site in the Kurnool district is situated on the right bank of the Tungabhadra. The site has been assigned to a period ranging from first century B.C. to third century A.D. The urban centre was protected not only by a rampart wall constructed of Cuddapah slabs, but also by a moat all round it. It had a facing of burnt brick and the southern part of the site is dominated by an elaborate gateway complex. A flourishing bead industry seems to have existed there. The spurt of urban centres in the Satavahana territory is well reflected in epigraphic records which name towns and refer to *nagara* (urban centres) and *nigma* (market centres). The eastern Deccan which from the time of Gautamiputra Satakarni became an integral part of the Satavahana empire also came under the impact of growing urbanism. Several excavated sites like Amaravati, Bhottiprolu, Salihundam, Nagarjunakonda, all situated in the Krishna delta, show urban dimensions and Buddhist association.[161] This area figures prominently under the name Maisolos/Masalia in the *Periplus*[162] and Ptolemy's *Geography*.[163]

The combined testimony of the Classical accounts, archaeological materials, epigraphic and numismatic evidence proves beyond doubt the existence of a flourishing economy. The proximity of the area to the eastern sea-board with a few important ports (for example Kontakossylla, Allogygne emporia)[164] dotting the coast, further enhanced the importance of the zone. The site of Dhanyakataka (lit. rice bowl) served as an inland port town, upto which the Krishna was navigable. Excavations have revealed the existence of a navigational channel connected with the river. The prosperous commercial economy is well attested to by epigraphic evidence of merchant guilds.[165] One of the most impressive sites is Nagarjunakonda which was naturally fortified by surrounding hills on three sides. A fortified area within the site is indentified with royal residence. Nagarjunakonda incidentally was the capital of Iksvakus who ruled from *c*. 225 to 330 A.D.[166]

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[159] H.D. Sankalia, *From History to Pre-History at Nevasa*, Poona, 1960.

[160] N.C. Ghosh, *Excavations at Satanikota*, Delhi, 1986.

[161] H. Sarkar and B.N. Mishra, *Nagarjunakonda*, New Delhi, 1972; H. Sarkar and S.P. Nainar, *Amaravati*, New Delhi, 1972.

[162] *Periplus*, section 62.

[163] Ptolemy, VII. 15.

[164] Ptolemy, VII. 15.

All residential stuructures were situated outside the fortified area and concentrated in the eastern part. Broad roads, cross-roads and bylanes do underline the impressive layout of the city. The site also contained religious structures of Buddhist and Brahmanical people. One of the most important urban structures was the amphitheatre with tiered gallery accommodating no less than 1000 spectators.[167]

The far south, dominated by the Colas (in the Kaveri delta), the Pandyas (near Madurai) and the Ceras (in Kerala), also came within the scope of urbanization. The Sangam poems, the earliest Tamil literature, contain graphic, but often stereotyped, accounts of towns and cities.[168] Excavations at several sites have recently revealed growth of urban centres, though the material remains do not often tally with the flourishing condition of cities described in early Tamil literature.[169] One of the most significant centres was Kaveripattinam (Khaberos emporium of the Classical authors) which was the Cola capital. The Sangam texts and the two epics the *Manimekalai*[170] and the *Silappadikaram*[171] eloquently describe the city. Archaeological remains would confirm the existence of the site from *c*. third century B.C. to fifth century A.D.

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165. R. P. Chanda, 'Some Unpublished Amaravati Inspections', *EI*, XV, 258-78.
166. The Iksvaku rule in the Krishna-Godavari valley and the Krishna delta followed that of the Satavahanas. Four rulers of the Iksvaku family are known from their epigraphic records. A century of the Iksvaku rule, with each of the four rulers being assigned an average period of 25 years, in the Krishna delta is not unlikely. The Iksvaku rule terminated when Abhira Vasusena (Nagarjunakonda Inscription of Abhira Vasusena) conquered the area in question in or around *c*. 330 A.D.
167. H. Sarkar and B.N. Misra, *op. cit.*
168. R. Champakalakshmi, 'Archaeology and Tamil Literary Tradition', *Puratattva,* 8, 1975-76, 110-22.
169. *Ibid.*
170. S.K. Aiyangar, *The Manimekalai in its Historical Setting,* London 1938.
171. *Silappadikaram,* tr. V. R.R. Dikshitar, Madras, 1939.

A brick structure indentified with a wharf suggests its importance as a port. Several public tanks/baths, frequently described in literary accounts, may be seen in the remains of semi-circular brick structures with water reservoir and an inlet channel connected with the Kaveri.[172] The well known site of Arikamedu, often identified with Poduca emporion of Ptolemy seems to have been occupied from the first to third century A.D. Its distinctive features as a trading station is evident not only by its closeness to the sea but also by the remains of a large warehouse. Presence of Graeco-Roman merchants at this site is inferred from typically Graeco-Roman intaglio designs on two gems, a red-glazed ware and Roman lamps and glass wares.[173]

The foregoing discussions may highlight the fact that the most distinctive feature of the material milieu of early historical India is the process of urbanization. This Second Urbanization had its primary manifestation in the middle Ganga valley, but it gradually assumed a pan-Indian character. The spread of urbanism from north Indian plains to the Deccan and far south went through two corridors : one in the western Deccan and the other through the forests of central India across the Andhra coast towards the Tamil country. It would be extremely difficult to discern the single dominant factor in the process of Second Urbanization. Despite the multiplicity of and controversies about the definition of an urban centre, there may be some consensus in the view that a city is essentially populated with a non-agricultural community which depends for its livelihood on crafts, trade, various services and administrative functions. It is not therefore surprising that many authorities would ascribe greater importance tc growth of trade and commerce and rise of administrative centres as contributing factors to urbanization. But it may be rightly argued that the non-food producing community of an urban centre cannot survive without an agricultural surplus which was grown in its rural hinterland. The extraction of the surplus from agriculture was no less important than its production ; the gradual consolidation of a power sructure could demand and realize the collection of surplus through a regular machinery. It was not

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172. *IAR*, 1962-63, 13, *IAR*, 1963-64, 20.

173. R.E.M. Wheeler, *op. cit.*, *AI*, 2, 1946, 17 ff.

merely an historical accident that led to the first appearance of cities in early historical India in the middle Ganga valley in *c*. 600 B.C. That area in question had the potential to produce the surplus and to generate and sustain the forces conducive to urban growth.

The same area also showed a definite inclination towards the formation of state power in the place of lineage-based polities. A strong agrarian base which was ably exploited by an increasingly crystallized power structure appears to have provided the foundation of the emergence of cities in early historical period. Though proliferating crafts and the steadily developing trade (particularly foreign trade) were responsible for lending maturity to the urban process, these are to be assigned a position secondary to the agrarian growth.

This pattern is first seen in north Indian plains though not necessarily confined to it. The Deccan witnessed urban growth subsequent to that in the north. Whether it was the western Deccan or eastern Deccan, urban growth there is primarily linked up with agrarian expansion. The point has been demonstrated by Himanshu P. Ray[174] and more emphatically by H. Sarkar.[175] Sarkar argues very forcefully that archaeological and literary evidence of urban development in the Andhradesa highlights that most cities were agrarian ones, i.e. "the market for selling and exchanging agricultural products", and they "far outnumber other types."[176] He is aware of the presence of a number of flourishing centres of trade on the Andhra coast, but maintains that most "early cities of Andhradesa depended heavily on plant and animal products"[177] and assigns to industry a rather secondary position as a factor behind urban growth in the area concerned. Like the Ganga valley, the Godavari valley was very much suited to rice cultivation and it is precisely this area where sprang up most urban centres.

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174. Himanshu P. Ray, *op. cit.*, see particularly the chapter on 'Agrarian Expansion and Trade'.
175. H. Sarkar, 'Emergence of Cities in Andhradesa', in B.M. Pande and B.D. Chattopadhyaya (ed.), *Archaeology and History*, Vol. II, Delhi, 1987, 631-42.
176. H. Sarkar, *ibid*, 635.
177. H. Sarkar, *ibid*, 639.

It is quite clear that the agrarian potential could not best be exploited in the Deccan before the emergence of a consolidated political authority. While the interrelation between urban growth and state formation in north India is more or less accepted, the picture is hardly clear in the Deccan. It is quite evident that the rise of the Satavahanas as the first imperial power of the Deccan played a crucial role in urbanization thereof. But the passage from pre-state polity to the emergence of the Satavahana monarchy is not as yet clearly understood. B.D. Chattopadhyaya makes an interesting attempt to identify the process "of the emergence of what we may call localities".[178] These localities may correspond, in absence of a suitable term in the context of the Deccan, to north Indian *janapadas*. Chattopadhyaya suggests that "the transition from the phase of uninscribed coins to that of inscribed of local rulers" may indicate the 'political profile' of "emergent localities accross the Deccan".[179] The process reached its culmination obviously in the pan-Deccan empire of the Satavahanas in subsequent times.

The crystallization of a state-society in the Deccan seems to have facilitated demanding and then realizing the surplus from the agrarian sector, which in their turn led to the emergence of cities in trans-Vindhyan India.

It would be unfair if all cities of early historical times were put into one straightjacket of agro-cities. The coastal towns, especially of far south, could hardly have grown to such great proportions but for the impact of Indo-Roman trade. In the plains of north India the city of Mathura presents an interesting departure from the general pattern. Mathura is not known to have been situated in an area famous for its fertility and neither capable of raising an agricultural surplus. The *Avasyaka curni* and *Brhatkalpabhasya* explicitly state that Mathura's prosperity depended not on agriculture but on trade.[180] Moreover, this trade at Mathura was hardly based on terminal trade, because Mathura could really boast of only one commodity of her own, i.e. its textile products.

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[178] B.D. Chattopadhyaya, 'Transition to the early Historical Phase in the Deccan : A Note,' B.M. Pande and B.D. Chattopadhyaya (ed.), *Archaeology and History*, Vol. II, New Delhi, 1987, 728.

[179] B.D. Chattopadhyaya, *ibid*, 729.

[180] B.N. Mukherjee *MIS*, 195, note 200.

Mathura appears to have thrived on transit trade. It prospered because of the growth of Indo-Roman trade and also because it emerged as a nodal point where several important overland routes converged.

Urbanization as a social and cultural process manifests the tendencies of the transformation of a simpler society into a more complex one. This was more or less valid in the case of Second Urbanization also. The population in an urban centre was not only more dense than in a rural settlement, but was heterogenous too. As the early historical India witnessed arrival of large number of foreigners in the wake of migration, invasion and trade, the urban society was bound to be heterogenous. Culturally speaking, the arrival of new people and their admixture with local populace would lead to acculturation and synthesis. As barriers of thoughts would be lowered down in such a situation, new forms of cultural expression would assert themselves.[181] The urban centre, being by nature more open to the intermixture of people and ideas of varied types, would be the ideal theatre for the interplay of diverse cultural elements. This would automatically encourage freshness of thought and a spirit of enquiry and along with that a protest against earlier orthodoxy. One cannot possibly miss the fact that the early historical period marked not only the emergence and growth of cities, but also is considered as one of the most creative ages in Indian history.[182] Apart from the voluminous creative literature, this age produced medical treatises like the *Caraka-samhita*, the *Susruta-samhita*, astrological treatises like the *Romaka siddhanta* and the *Yavanajataka* of Sphujidhvaja, the vast legal literature (Dharmasastras) and the great treatise on polity, the *Kautiliya Arthasastra*.[183]

The spirit of enquiry and freedom of thought must be seen in the social background where patrons of religious and cultural movements rarely referred to their *varna* affiliations but indicated their occupational standings.[184] A marriage between a jeweller and an ironmonger was hardly frowned upon,[185] though it violated the orthodox Brahmanical norm. How much open the society was can best be appreciated from the fact that a courtesan could make donation to Jaina religious organization without at all renouncing her profession or suppressing her mother's profession which was the same.[186] The growth of urbanism, expansion of trade, and increasing monetization seem to have relegated the importance of birth as a determinant of social status. The *Angavijja* refers no less than four times and in at least four different ways to existing social groups. First it enumerates the traditional four *varnas*. Then it speaks of social status being determined by birth as well as occupation (e.g. a Bamhana-Vessa, i.e. Brahmana by birth and Vaisya by profession). In the third place the society is said to have been divided into two : *ayya* (*arya*) or nobles and *milikkhu* (*mlecchas*). The last description divides the society into two : *ayya* (*arya*) or free men and *pessa* or servile community. The text categorically states that the *Sudda* could also belong to *ayya* group.[187] This indicates that (1) society was divided into broad classes : freemen and slaves, and (2) social position was not determined by birth alone but also by the occupation of the person concerned. In other words it implies that a *sudra* could raise himself to the status of an *arya* by improving his economic condition, despite his 'low' birth. The impact of wealth appears to have put the age-old, traditional, orthodox, Brahmanical social norms to severe strain. Thus to Caraka the motivating factors behind all human actions were "desire for life, desire for riches and desire for future life". He further adds that the physician's wealth was not made only of the goodwill generated by the relief given by him to his patients, but also by material wealth and patronage secured by him from kings (*isvarah*) and wealthy persons (*vasumantah*).[188] Only the latter factors could provide him an easy and comfortable life. The epitome of the changed attitude and life style was best expressed in the urban milieu. That is why the *Kamasutra* has the *nagarka* (citybred man) at the centre of the life style it advocates.[189] One may here also remind the famous passage of Kalidasa that nobody should take a gem to a village for assessment when a city (*pattana*) is available.[190]

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[181] B.N. Mukherjee, Presidential Address, Section I, Indian History Congress, Bodhgaya session, 1981.

[182] The period between the fall of the Mauryas and the rise of Gupta empire is viewed as one of disintegration, a 'Dark Age' by S. Chattopadhyaya, *Early History of North India*, Calcutta, 1958.

[183] B.N. Mukherjee, (ed.), *India in World Wisdom*, Calcutta, 1986.

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[184] This is best illustrated by the large number of donative records of the early centuries of the Christian era when donors almost invariably recorded their occupations/professions, but very rarely their caste (*varna/jati*) status.

[185] K.L. Janert, *op. cit.*, 383, inscription no. 4.

[186] *LL,* no. 102.

[187] *Angavijja,* ed, Muni Punya Vijayaji, see ch. 2. sec. 40-46, 101-103 ; ch. 57, sec. 218, ch. 24, sec. 149. Also see B. N. Mukherjee, *op. cit.*, *IHR,* vii, 1-2.

But this is, however, only one version of the story. The orthodox Brahmanical view could hardly tolerate the relatively open attitude of cities. The city became, as it were, almost a by-word of aversion and contempt to *Sastrakaras*. As early as the days of *Gautama Dharamasutra* the city is damned because of perpetual *an-adhyaya* (non-recital of Vedas).[191] The injunction continues in the *Manusmrti*[192] and *Vasistha Dharmasastra*.[193] A kind of ruralism permeates the attitude of law-givers who looked askance at cities. Sociologists opine that a high degree of tension generally exists between the urban and provincial lives. It is true that these two elements are interdependent but are separated by a gulf of mistrust, suspicion and contempt. Yet, there was a remarkable penchant for urbanism in early historical India which seems to have echoed a German maxim "stadtluft macht frei" (The city air makes you free).

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[188] B.N. Mukherjee, *op. cit., Indian History Congress.*

[189] *Kamasutra of Vatsyayana,* Nirnayasagar edition, Bombay, 1900, tr. K.R. Aiyangar, Lahore 1921. For the life of *nagaraka,* see H.C. Chakladar, *Social life in Ancient India : Studies in Vatsyayana's Kamasutra,* Calcutta 1929.

[190] This famous verse occurs in Kalidasa's *Malavikagnimitram,* Act. I.

[191] *Gautama Dharmasutra,* XVI. 43.

[192] *Manusmrti* IV. 107.

[193] *Vasistha Smrti,* XIII. 1.

Abbreviations

AI — *Ancient India*

EI — *Epigraphia Indica*

IAR — *Indian Archaeology : a Review*

IHR — *Indian Historical Review*

JBBRAS — *Journal of the Bombay Branch of the Royal Asiatic Society*

JESHO — *Journal of the Economic and Social History of the Orient*

JNSI — *Journal of the Numismatic Society of India*

LL — *H. Luders, A List of Brahmi Inscriptions from the Earliest Times to 400 A.D. (with the exception of those of Asoka), being an appendix to Epigraphia Indica, X.*

MASI — *Memoirs the Archaeological Survey of India*

PHAI — *H.C. Roychaudhuri, Political History of Ancient India, Calcutta, 1972.*

N.B. Readers may profitably utilize A. Ghosh (ed.) *An Encyclopaedia of Indian Archaeology* (in two volumes), Delhi, 1989 for information regarding many of the urban sites discussed in this paper. This Encyclopaedia however could not be consulted by the present author.

APPENDIX II

TECHNOLOGY OF EARLY INDIAN COINAGE

B. N. MUKHERJEE

I

In an early form of economy in a society of the ancient period the system of barter could have been replaced, at least partially, at a certain stage of its (i.e. the economy's) development by a method of exchange by commodity money (consisting of different types of useful and/or valuable objects including precious metals). In a later stage pieces of metal, weighing according to a particular weight standard, might have begun to be used as media of exchange. This metallic currency was likely to usher in still later the introduction of another medium of exchange consisting of coins, which were also pieces of metal of a prescribed weight, but were additionally embellished with designs and/or legends indicating the authorities (private or public) guaranteeing their worth (so far their weight, purity and value were concerned). The laborious process of weighing (and testing) the pieces of metal at each transaction was obviated by the acceptance of coinage.

Thus metal used to facilitate exchange of goods is money. Intrinsically valuable metal pieces of a definite weight employed for the same purpose form a metallic currency. Such pieces with devices and/or legends become coins.

Of all sections of people, the traders, who lived on sale of goods, must have been most concerned for a useful and portable medium of exchange. So they might have been initially responsible for introduction of metallic currency and also of coinage. Later the government or public administration stepped in to ensure *inter alia* the circulation of a variety of coins over a wide territory controlled by it. The government invested the coinage with an imposing authority which could not be bestowed by traders or trading agencies, though their issues could also travel (along with itinerant merchants) far beyond the place of their origin.

Available data suggest that the establishment of great states (mahajanapadas) in the 7th-6th century offered the merchants of each state the opportunity for travelling comparatively peacefully over a wide territory under one single political authority, which was likely to encourage commerce as a potential source of revenue. Brisk trade required an easily portable and readily acceptable medium of exchange. Metallic currency was already there. But for the ready acceptance of these pieces a well-known trader or trading corporation had to impress his or its insignia on them guaranteeing their weight and purity. The early coin-name *pana* can indeed be related to the term *panya*, signifying *inter alia* an "article of trade". Thus traders seem to have initiated coinage in the Indian subcontinent. Later the state stepped in to ensure the acceptance of coinage by all classes of people as well as for using it for its own benefit.

Archaeological and literary sources suggest that the first coins of the subcontinent were minted in the 6th-5th century B.C. The control of state over minting of coins and the currency system was complete during the days of the Mauryas (late 4th-early 2nd century B.C.). From that period onward the early Indian monetary system went through various vicissitudes experiencing varying degrees of control of the state or local bodies or private agencies.[1]

II

Each of these minting authorities apparently had its own administrative mechanism for issuing coins. Unfortunately the mint organisation of early India is not known in all the desirable details. However, the actual production of coins obviously involved (as it also does now) procurement of metal(s), preparation of blanks, manufacturing of apparatus for minting and the actual process of minting.

Sources of our knowledge of minting coins in ancient India consist of indications given by the relevant coins, archaeological finds (other than coins) and references in literature. The extant specimens of coins are (mainly) in silver, copper, gold, lead, billon, potin, bronze and brass.

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[1] For a discussion on the origin of coinage in India see Appendix II of our monograph *Technology of Indian Coins*, Calcutta, 1988.

On the basis of discernible minting techniques, ancient Indian coins can be broadly divided into four classes, viz. (i) archaic die-struck including the so-called 'punch-marked', (ii) cast, (iii) repousse and (iv) die-struck. In contradistinction to the coins of class I those of class IV may be characterised as "sophistically" die-struck.

Devices on a large number of silver and copper coins do not cover the whole or most of the flan. Here the devices are impressed by separate punches with dies 'applied irregularly at various points on the surface'.[2] This peculiarity led J. Prinsep to use the term 'punch-marked' for describing this series of coins.[3] For manufacturing such pieces a prescribed amount of metal (and alloying materials) should have been melted in a crucible and the molten metal was left to be cooled as a lump or was cast into sheets of required thickness. In case of a lump, it had to be beaten out into a sheet. Strips, cut out from sheets of this type, were divided into pieces of same weight and final adjustments were made by cutting small bits from one (or more than one) corner of heavier pieces. Where such trimming was not necessary the pieces cut out from the sheets could be roughly of the required size (square, squarish, rectangular, oblong, bar-shaped, round, nearly round, oval, etc.).[4] If the sheet was very thick, the rectangular or square pieces cut out of it would look like ingots.[5] These pieces of prescribed weight, technically known as blanks, were probably slightly heated and then impressed with devices from different dies punched on them on one or both of their two sides (oberse and reverse). The deeply struck devices would look like independent incuses on a flat and fairly broad surface. If a bar-shaped blank was struck heavily, while still hot, with two devices

[2] V.A. Smith, *Catalogue of the Coins in the Indian Museum, Calcutta*, Oxford, 1906 (cited below as *CCIM*), p. 131.

[3] *Journal of the Asiatic Society* of Bengal, 1935, vol. IV, p. 627.

[4] J. Allan, *A Catalogue of the Indian Coins in the British Museum, Catalogue of the Coins of Ancient India, London*, 1936, (cited below as *CAI*), pl. 11f.

[5] *CCIM*, vol. I, p. 136 ; S.P. Basu, *The Second Supplementary Catalogue of Coins* (*to vol. I*), Calcutta, 1977 (cited below as *SSCC*), p. 4 ; I, 1-2.

at two ends, it would naturally bend in the middle resulting into a bent-bar coin.[6]

Some irregularly oblong or roundish coins give the impression of having been formed out of drops of molten metal. Here the dropped blank (in contradistinction to cast blank or beaten out lump blank) was perhaps stmped with symbol or symbols while still in a semimolten stage.[7] A number of saucer-shaped coins[8] and numerous small coins[9] might have been minted with the help of dropped blanks. If the quantity of dropped metal was sufficient enough to be impressed by only one die and if the die was struck very hard, the blank would have resulted in a saucer-shaped coin.[10] In case of the dropped metal having been very small in quantity (looking like a small molten globule), the resultant blank was very small in size, often not being spacious enough to receive the impression of even one die.[11] However, such cup-shaped and minute coins could well have been produced out of beaten-out or cast blanks.[12]

All these varieties of specie were struck with dies. So all of them can be broadly called die-struck coins. However, they lack the more sophisticated technique and appearance of regular die-struck pieces. Both sides (obverse and reverse) of most of the latter pieces appear to have been struck simultaneously with two dies (obverse and reverse dies). On the other hand, the archaic die-struck pieces bearing more than one symbol on at least one side seem to have been impressed with them by punches from different dies, all of them having not been struck simultaneously (even when impressed on one single occasion). Such pieces, which received more than one 'punch' should be strictly called 'punch-marked'. These as well as the others bearing not more than one 'punch' on one side may be loosely classed under the category of 'archaic die-struck pieces'. There are indications that the coins displaying not more than one symbol or mark on one side were in circulation in *inter alia* the period of regular minting of 'punch-marked' pieces.[13]

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[6] *CAI*, pl. I, no. 2. In this connection see also D. Sellwood, "The Interaction between the Early Minting Technologies of East and West", P.L. Gupta and A.K. Jha (editors), *Numismatics and Archaeology*, Nasik, 1987, p. 125.

[7] *The Journal of the Numismatic Society of India* (cited below as *JNSI*) 1973, vol. XXXV, pl. I, no. 13. Valdettaro and, following him, A.N. Lahiri call the pieces in question as "Droplet" coins (*ibid.*, 1976, Vol. XXXVIII, p. 4). The word "droplet" means "a little drop". But the blank of this type of coins might have been produced by a large drop or several small drops of metal. So it is wise to categorise the blank simply as made of "dropped" metal. Some dumpy silver coins found at Bhabua in the Sahabad district might have their blanks prepared in the same way (*ibid.*, 1973, pl. 1, no. 13).

[8] *CAI*, pl. I, nos. 16-19.

[9] *SSCC*, pl. I, nos. 10-11.

[10] *JNSI*, 1976, vol. XXXVIII, p. 4.

[11] *Ibid.*, p. 5.

[12] Examination of several pieces of these types of specie gives this impression.

The evidence of the larger Bhir mound (Taxila) hoard indicates the circulation of the punch-marked coins in the 4th century B.C.[14] The contents of the Chaman-i-Hazuri hoard may be considered to allude to the minting of the punch-marked pieces even in the 5th century B.C.[15] The use of the punch-marked coins on a large scale in the Maurya period has already been suggested.[16]

In the light of these inferences we can discuss the minting of coins as indicated in the *Arthasastra* of Kautilya, generally attributed to the Maurya age (late 4th-early 2nd century B.C.).[17] Kautilya referred to a list of objects used in the atelier of a counterfeiter of coins (*Kutarupakaraka*). These include metals, alkali, crucible, charcoal, bellow, tongs, hammer, chisel, anvil and (die engraved with) design (*bimba*).[18] Same articles were apparently used in a regular mint. It appears that lumps of metal were fired with purifying agents (including some other prescribed

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13. P. Curiel and D. Schlumberger, *Tresore monetaires d' Afghanistan*, Paris, 1953, pp. 31f ; pll. II-V ; J. Marshall, *Taxila*, vol. II, *Cambridge*, pp. 843-851 ; B.N. Mukherjee, "Tiny Coins of Malwa", *D.D. Kosambi Commemoration Volume*, Varanasi, 1977, 68, also see below n. 14.
14. J. Marshall, *Taxila*, vol. II., pp. 843-45.
15. R. Curiel and D. Schlumberger, *op. cit.*, pp. 31 ; pl1 II-IV.
16. *CAI*, p. LXXI.
17. R.C. Majumder (editor), *The Age of Imperial Unity*, Bombay, 1951, pp. 274-275 and 285-387. See also B. N. Mukherjee, "A note on the *Arthasastra*" (Foreword to the *Kautilya's Arthasastra* by N.P. Sil, Calcutta, 1985). Several scholars have tried to date the text to later periods (*AIU*, pp. 285-287).
18. *Kautilya Arthasastra*, V. 4. 20.

metal).[18a] Then prescribed quantities of 'purified' metal lumps and alloying materials were melted in crucibles and the molten mixed metal (including the hardening alloy) was cast into sheets (or mixed metal lump was hammered into sheets). The sheets or strips from the sheets were cut into pieces of required size and weight. The sheets or blanks could be blanched with alkali. Then the blanks (cold or slightly heated) were placed one after another on the anvil and stamped by the die (bearing the design in negative) with the help of a hammer. If more than one design was to be impressed on the blank in one single operation, relevant number of dies (each carrying one design in negative) were used one after another. Kautilya recommended minting of silver and copper coins. According to him, the Lakshanadhyaksha (i.e. Mint-master) should manufacture 'silver' coins with one fourth part copper and a *masha* of supporting material (*vija*) (i.e. hardening alloy) consisting of iron, tin, lead, or antimony.[19] In a silver coin of *pana* denomination, weighing 16 *mashas*,[20] only 11 *mashas* were of pure silver. In case of a copper coin the sustaining material (*ajiva*) (i.e. hardening alloy) was one-fourth of its total weight.[21]

[18a] The *Arthasastra* refers to the purification of impure silver by adding lead to the extent ofone-fourth of the weight of the silver (II, 10, 13) and apparently by heating the total mass of metal. In another place the same text recommends that impure silver should be heated four times in a crucible of bone (i.e. made of a mixture of clay and bone dust ?), four times with equal amount of lead (in a pot of clay), four times in a dry crucible, three-times in a pot-sherd and twice in cow-dung and then it should be made bright with Indus-earth (II, 13, 49). According to Pliny, silver ore "cannot be smelted except when combined with lead or with the vein of lead, called galena, lead ore, which is usually found running near veins of silver ore. Also when submitted to the same process of firing, part of lead precipitates as lead precipitates as lead while the silver floats on the surface, like oil in water (*Naturalis Historia*, XXXIII, 31, 95). For the purification of crude gold the *Arthasastra* indicates the use of lead and heating of the mass by cow-dung fire (II, 13, 9). The sufficiency in the degree of purification was to be attested to by an equation of the quality of the colour of two lines drawn on a touchstone, one by a piece of pure gold and the other by a part of the material (*varnika*) already heated for attaining fineness (II, 13, 17).

[19] *Arthasastra*, II, 12, 24. For Kautilya's prescription for purification of different types of metal, see *ibid*. II, 13.

[20] *Ibid*., II, 19, refers a *dharana* of silver as weighing 16 *mashas*. *Dharana* as the name of a silver coin was of the denomination of silver *karshapana*, *pana* or *purana*.

The method of coining indicated by Kautilya might well be applicable to the manufacturing of many of the above noted types of archaic coins including 'punch-marked' pieces. Unfortunately archaeological remains of any mint used for producing such coins have not yet come to light. Nevertheless, we have data to indicate at least the major stages in the production of these coins. The manufacturing method does not appear to have been very sophisticated. In fact, the practice of stamping semi-molten lump or drop of metal or striking the blank successively (or at interval) from different dies (as on punch-marked pieces) was laborious as well as detrimental to the quality of production. However, devices or symbols stamped carefully with well engraved dies could have produced clear and artistic reproductions on blanks.

III

A great number of coins carry devices, which are not as sharply cut or clear as those on a great number of archaic coins including the 'punch-marked' series. These devices seem to have been impressed on coins not by hard striking, but by casting metal in moulds bearing the required impressions in negative. The process of manufacturing these coins involves preparation of mould(s), melting of metal and casting of the latter in the mould(s). The negative of the intended coin-type could have been engraved or etched on a blank mould made of heat-resisting plastic clay or on a mould in cast metal. It was perhaps technically also possible to have the metal mould with the intended impression by casting the required amount of molten metal in a clay-mould bearing the positive of the impression in relief. Similarly, according to an alternative and possibly more convenient method of preparing a clay mould for producing coins, the intended coin-device could have been carved in relief on a lump of clay or on a piece of metal. It

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24. *Ibid.*, II, 12, 24 ; According to Kautilya, a *rupadaraska* or coin-examiner should test the purity of *hiranya* (*ibid.*, II, 5). The term *hiranya* generally means "gold" or "gold coin". It may, however, also refer to coin in general.

was not difficult to rectify the positive impression, if it was found necessary. The latter, made either in clay or metal, served as a model. By pressing this positive impression on a lump of heat-resisting plastic clay, specially prepared according to the shape (round, rectangular, square, etc.) and size of the intended coin, a mould was made, consisting of the intagliated negative impression. The mould with raised rim around the coin-socket was then baked.

Molten metal of pre-determined quality and quantity, was now poured into the mould. Gradually hardened, it would receive the positive impression of the type found in negative on the mould. Some copper coins bearing device only on one side[22] may have been minted following this process.

If a coin was destined to carry devices on both faces, a second mould had to be prepared and an opening made through the rim of each of the moulds. The openings as well the moulds were then joined face to a face. Molten metal could now be poured through the channel and into the cavity thus formed.[23]

Some cast coins found still joined together by a bar of metal[24] indicate that these were cast in pairs. Each pair of moulds (bearing obverse and reverse devices), facing each other, were joined with another pair of moulds by a channel. Molten metal poured probably through a hole in the channel, could flow into each socket. But in the process some portion of the metal could have sometimes dried up in the channel resulting in a bar joining both the coins. Ordinarily the bar should have been broken and detached from coins. But sometimes this was (mistakenly) left attached to the pair of coins.

Some of the Yaudheya coin moulds, found at Sunet,[25] consist of pairs of discs bound together back to back (i.e. by their blank faces) with the help of morter. This evidence suggests that sometimes pairs of discs, each forming a set of moulds for obverse and reverse devices, were placed one above the other so as to make a cylindrical pile. The engraved faces of each pair of discs faced each other, while the blank of each of them was attached to the outer side of the immediately upper or lower pair (as the case might be). The opening on the rim of each pair (as indicated in the last but one paragraph) was usable for channeling molten metal into the inner side. Available data indicate that the series of discs was then plastered over on the outside, leaving only the channels leading to the sockets uncovered. Molten metal could now be poured into different moulds separately, or, which was more likely, it could be made to flow down through a vertical hollow column communicating with the channels leading to the coin sockets of the moulds placed vertically. The practicability of the latter method is indicated by the 'U'-or 'V'-shaped cut leading right into the socket of some Sanchi and Sunet moulds.[26] For the deep cutting through the side of each of these moulds seems to have been designed to allow the molten metal run directly into the socket from some central channel (like the above mentioned vertical hollow column).

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[22] *CAI*, p. 129 ; pl. XVI, no. 6. For a bronze mould, wrongly described by Cunningham as a bronze die, see A. Cunningham, *Archaeological Survey of India, Report, Tours in Baluchistan and Malwa in 1874-75 and 1876-77*, vol. X, reprint, Varanasi, 1966, pp. 77-78 and pl. XXIV, no. 1.

[23] For pairs of moulds used for forging coins see B. Sahni, *The Technique of Casting Coins in Ancient India*, Bombay, 1915 (cited below as *TCCAI*), pl. IV, nos. 110-116.

[24] *CAI*, pl. XII, nos. 1-2.

[25] *TCCAI*, p. 35 and figs. 18-19.

The method of letting the molten metal flow down the hollow column was less time-consuming than that of pouring through the opening in each pair of discs. In the former case several coins could be made in one single operation. However, it also had greater risk of loosing part of the metal before reaching the socket. Commenting on the above noted moulds from Sunet, B. Sahni has observed that two or more cylindrical piles of moulds could have been joined together "round a vertical axis so as to bring all the individual channels into communication with the single axial canal fed through a crater at the top".[27] Similar Roman coin moulds have been discovered at Lingwell Gate in England.[28] It is significant to note that the Sunet moulds of the later Yaudheya coins are to be dated long after the inception of Indo-Roman trade.

More interesting are the discoveries of several coin sockets in single coin moulds. The shape of such moulds is either rectan-

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26. *Ibid.*, pp. 37 and 48.

27. *Ibid.*, p. 36.

28. *Ibid.*, pp. 36 and 52 ; pl. VII, figs. 143-45.

gular (as that of an Atranjikhera or Taxila piece)[29] or circular (like that of several Taxila finds)[30] in shape. The rectangular coin mould from Atranjikhera displays the negative impressions of Huvoishka's coin devices in sockets arranged in rows. Only the sockets of the row nearest to the opening on the rim of the mould received molten metal through channels connecting them with the opening. Each of the sockets in succeding rows received metal through the channels connecting it with the nearest sockets of the earlier row and also of the same row.[31] Pairs of such moulds were often used to be fixed face to face with the help of tenons and were probably plastered over.[32] Several Taxila moulds, however, do not betray traces of tenon or mortise. Here "the funnel-like inlet on one side of a mould narrows into a final canal which feeds the nearest coin socket and it is from this socket that all others have to be fed by narrow connecting channels".[33] A similar arrangement was noticed by J. Dattari in some Roman moulds discovered in Egypt.[34]

A complete set of three discs, found at Mathura, have the top and bottom ones blank on their exposed sides. Their inner faces bear coin-sockets, while the central discs have coin-impressions on both faces. Traces of luting on the outer side indicate that these were plastered over. A part of the edge of the middle disc was cut away into a 'V'-shaped notch, with a straight channel on each face leading from the notch to a point just beyond the centre. From this main channel four short branch channels came off at straight angles, two from either side of it. The ends of these four channels and that of the main channel itself, communicated with the five coin sockets. To complete the opening at the edge of the triple mould, the two outer discs were excavated on their inner sides into shallow depressions which were either fitted opposite each other (on either side of the notch in the middle disc), or lay obliquely on two sides of the middle disc.[35] Molten metal could be poured through the channels made of the above noted 'V'-

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[29] *Ibid.*, pl. VI, no. 126 and pl. V, no. 123

[30] *Ibid.*, pl. V, nos. 119-122.

[31] *Ibid.*, pl. VI, no. 126.

[32] *Ibid.*, p. 47, but also see p. 41.

[33] *Ibid.*, pp. 41 and 48.

[34] *Ibid.*, pp. 42 and 54.

[35] *Ibid.*, p. 46.

shaped notches (on two sides of the middle disc) and depressions (on the inner sides of the outer discs).

The most elaborate process of coin-casting has been revealed by the fragments of early Yaudheya coin moulds found at Khokrakot, near Rohtak. Each disc seems to have a hole in the centre, from which radiating channels run into eight coin sockets arranged in a circle.[36]

B. Sahni thinks that at first a clay disc was prepared around a peg on the middle of a base plate enclosed by a hollow cylinder. Then an eightrayed metal with a hollow centre was slipped down the peg and pressed on the clay. At the end of each of the radiating channel, thus excavated, "a coin model" was pressed to create a coin socket bearing the negative impression of the obverse or reverse concerned.[37]

Two discs, prepared in this way and coupled face to face, made one pair. Two such discs, one carrying the obverse and the other reverse impressions, were coupled face to face and fixed to each other with the help of tenons. Several pairs of discs, placed one above the other and marked with grooves cutting the outer face of the rims, formed one set. A number of such sets, dried up in sun, were placed one above the other. These were then plastered over with a paste of clay mixed with unhusked grain and then baked in a furnace. However, the central hole of the top disc and so of all discs were left open[37a] with the help of a funnel like opening at the top.

These holes formed a hollow shaft. Molten metal poured down through it (with the help of a funnel-like object at the top) would run by means of the radiating canals of each pair of discs into the cavities of coin sockets. B. Sahni is of the opinion that casting was done when the pile of moulds was still hot. The pile was probably enclosed in a furnace into which wind was passed with the help of a bellow and the molten metal was poured in the manner described here. When the pile cooled down after the operation, it was broken up and coins were then taken out and cleaned.[38]

[36] *Ibid.*, pl. I, nos. 4 and 5.

[37] *Ibid.*, pp. 27-29.

[37a] *Ibid.*

[38] *Ibid.*

The Rohtak moulds may be compared with ancient Chinese system of casting coins 'in a circle',[39] or with a stone mould for casting ten Pao luh kwa coins "arranged like a tree whose stem and branches are the rivulets for the metal and fruits or leaves of the coins".[40]

A great advantage of the Rohtak system of casting coin was its capability of producing a very large number of coins in one single operation. However, an equally great disadvantage was that the moulds were broken and lost in that process. This drawback might not have been always faced in casting coin in moulds having one socket. At least we have evidence of producing coins in modern times from such ancient Roman moulds.[41]

As part of the metal was likely to be lost in channels and before reaching sockets, it was difficult to control weight of each and every cast coin. This fact explains the divergence in weight of cast coins of apparently one and the same denomination. A part of the metal hardened in the channel leading to a coin socket in a mould was sometimes left unseparated from the metal hardened in the socket. This distorted the shape of the coin produced from that socket. Again, faulty casting could allow formation of air bubbles in the metal, resulting in the fragility of the coins concerned. Moreover, mould-impressions were not always properly transferred (with all their details and sharpness) to coins, since such a transfer was not mechanically or manually controlled.[41a]

IV

The apprehension of losing matrices or of failure to ensure sharpness in devices on coins did not apparently plague the producers of a few classes of coins of thin fabric and light weight.[42] These pieces bear devices on one side only, the other side carrying only their negative impression. Apparently the thin flan of such a coin was placed on a piece of stone or metal displaying the positive impression of the device concerned either in high relief or in a sunken state. Then the thin blank was carefully hammered to receive on one side the positive impression of the device either in relief or in a sunken state (depending on the manner in which it appeared in the matrix). Consequently the other side of the thin flan got intagliated or raised traces of the device in negative. This process of transferring impression from a matrix to a piece of metal, popularly known as the repousse technique, allows production of numerous coins from one matrix and ensures good impression of the matrix-device on coins. But the repousse technique not only involves a laborious and time-consuming process, but also does not allow impressions of two distinct devices on two sides (obverse and reverse). The insignificant number of known pieces, minted according to this technique, indicates that the repousse method of production was least popular among the moneyers. Probably its defects outweighed its merits.[42a]

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[39] T. de Lacouperie, *Catalogue of the Chinese Coins in the British Museum*, London, 1892, p. XXV.

[40] *Ibid.*, p. XXVIII ; G. Macdonald, *The Evolution of Coinage*, Cambridge, 1916, p. 61 ; *TCCAI*, p. 55.

[41] *TCCAI*, p. 52.

[41a] The practice of producing cast coins in official mints declined after c. 3rd-4th century A.D. In the Gupta and post-Gupta ages the casting method was perhaps increasingly adopted by counterfeiters for imitating coins struck officially from dies. It is interesting to note that the moulds found at Kadal in the Deccan bear legends in the Nagari script datable to the period from the 11th to the 15th century (*TCCAI*, p. 49).

V

These difficulties faced in producing casts or repousse coins could have been obviated by following another technique of minting. We are referring to the system of producing coins with the help of well prepared blanks and dies (each of which, meant to be impressed, with the exclusion of others, on obverse or reverse, bears a cohesive picture of devices related to one another or such devices and legends or only a meaningful legend or a part of it). This system was, at least in the early centuries of its use, a sophisticated development on the above noted archaic diestriking (including 'punch-marking') techniques.

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[42] A.S. Altekar and B.N. Mukherjee, "Coinage", *A Comprehensive History of India*, vol. III, pt. II (edited by R.C. Majumdar), New Delhi, 1982, p. 1387.

[42a] This technique was followed for minting *inter alia* some thin silver pieces of great antiquity and a few series in the 6th century A.D. (P.L. Gupta and A.K. Jha (editors), *op. cit.*, p. 129).

Among the most well-produced die-struck series of specie of ancient India we can include the coins (or at least many pieces) issued by the Indo-Greeks, Scytho-Parthians, Kushanas and Imperial Guptas. The appearance of two distinct devices or rather two distinct sets of cohesive devices on their coins and traces of double striking on blurred faces of some of these pieces suggest that the coins of these rulers were struck from two separate dies, used probably simultaneously. The metal of die-struck coins of the Gupta and pre-Gupta periods consisted mainly of gold, or silver, or copper or lead or billon (an alloy of silver with copper or tin), or potin (a compound of copper, lead, zinc and tin).[43]

The exact process of extraction (or segregation) of crude metal from native metal deposits and also the exact process of purification or refining of crude metal varied from metal to metal, as suggested by medieval and modern experience.[44] However, a few early and medieval treatises perhaps indicate that firing of the metal was an essential part of each method.[45]

'Purified' remains of gold, copper, silver, etc., could have been melted and cast into ingots. 'Mixed' metal like bilon or potin could have been prepared by mixing prescribed quantities of molten metals and then casting the materials into ingots. These ingots supplied the basic materials for preparing blanks.

It appears that the required amount of basic material was first melted down. The molten metal could have been mixed with prescribed quantities of alloying materials (whenever necessary) as in the cases of preparing gold or silver coins. Then the required amounts of molten metal were probably poured into cir-

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43. A small number of coins, including a piece attributed to Chandragupta II, are considered to be made of brass (B.N. Mukherjee, *Art in Gupta and Post Gupta Coinages of Northern India*, Lucknow, 1985, (cited below as *AGPCNI*) p. 32, n. 41).
44. Thakkura Pheru, Dravyapariksha, 17f ; Abul-Fazl-i-Allami, *Ain-i-Akbari*, 6, 3-9, 7, 10-14 ; F.K. Viccaji, *Notes on the Hand Minting of Coins in India*, pp. 2f ; P. Ray (editor), *History of Chemistry in Ancient and Mediaeval India, (incorporating the History of Hindu Chemistry by Acharya Prafulla Chandra Ray)*, Calcutta, 1956, pp. 279f ; J.R. Parrington, *A Text Book of Inorganic Chemistry*, 6th edition, London, 1961, pp. 716f.
45. *Arthasastra*, IV, 4, 20 ; II, 13, 9 and 49 ; see also n. 44.

cular shaped moulds of regulated sizes.[45a] The blanks produced from the moulds could be heated and worked upon by hammering, etc., for achieving the required thickness and for destroying the brittle cast structure of their grains and thereby making them conducive to receiving the blow at the time of striking. Alternatively, the molten metal (mixed with alloying material) could have been cast into sheets or plates, which could be heated and worked upon and finally cut into round pieces of the size of the coined money.[46]

After preparation of blanks their weight might have been checked and adjusted according to the specified standard. We do not know whether, as in several manually operated mints of medieval and early modern times, the blanks were blanched by boiling them in a solution (like that of tamarind and salt)[47] in order to clean and perhaps also to soften them.

Preparation of dies was another important stage in production of coins. Impressions in relief on most of the well produced die-struck pieces suggest that devices on the relevant dies were hollowed out. We can guess two, if not more, possible ways for preparing these 'intaglio' dies.

[45a] Some clay-slabs or cakes were found at Bhambor and Brahmanabad in Sind. These "are about half to threequarters of an inch thick, upon one side of which are impressed rows of little cup-like hollows, forming a regular honey-comb pattern, while the lower sides have been subjected to great heat and are vitrified". A few of these were found during excavations at Bahmanabad along with some pellets, which fitted the hollows, and some copper coins, produced apperently by striking such pellets with dies. According to a hypothesis, these were "first heated upon a furnace to prevent sudden chilling of copper" poured into the cavities. After the molten metal became frozen in the hollows, they took the size and weight of intended coins. These slabs were used for minting coins of Arabic rulers (*Archaeological Survey of India,* 1903-04, p. 137 ; pl. XLVIII, no. b).

[46] *Numismatic Chronicle,* 1963, 224 ; S.K. Chakraborty, *A Study of Ancient Indian Numismatics, Mymensingh,* 1931, p. 114 ; *CCIM,* vol. I, pp. 197f. ; G. Macdonald, *op. cit.,* pp. 67-68 ; T. Hanson, *Coin Collecting,* London, 1965, pp. 13-14.

[47] F.K. Viccaji, *op. cit.,* pp. 2f ; S.K. Bhatt and others, *A Study of Holkar State Coinage,* Indore, 1976, p. LXXXV. It may be noted that *Kshara,* or caustic alkali, mentioned in the *Arthasastra* (II, 4, 20) as used by a forger for fabricating coins might have been used for *inter alia* blanching the blanks in regular mints. The same practice might have been employed in minting the die-struck coins under review.

Negative impressions of the obverse and reverse types (and inscriptions) could have been engraved, perhaps following an original design, on two separate dies of soft steel or bronze prepared by cutting into slices a bar of steel or bronzes cast in mould and then annealed (i.e. softened by heating the bar to a temperature somewhat below the melting point and then allowing it to cool slowly).[48] The engraving might have been done by a sculptor with the help of such instruments as a graber's wheel, drills of different shapes and sizes, a burin, a hammer and perhaps a compass.

We can consider an alternative and perhaps a more practical or an easier way of making dies. The sculptor could have engraved in positive the obverse or reverse design on a lump of specially prepared plastic clay containing alluminium silicate and so possessing high heat-resisting capacity and high softening point (PCE). The lump of clay displaying the design would have to be fired properly. Then the terracotta design or model could be covered by molten ingredients of steel or bronze for transferring the design in negative on the gradually hardened material.[49]

Increased hardness could be achieved in case of a metal die, prepared following the first or second process, by heating it to a temperature somewhat below the melting point and cooling it by water quenching.[50]

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48. G. Macdonald, *op. cit.*, pp. 64-65 ; J. Del Monte, *Fell's International Coin Book*, 4th edition, New York, 1961, p. 21. It was perhaps also possible to engrave the negative impression of a design on a block of stone and then to use it as a die. (In this connection see also *NC*, 1922, p. 2).
49. It was also possible to cut a positive design in high relief on the lower end of a bar or punch, and then to punch it on soft metal to produce an intagliated die with the negative impression. This method, known as hubbing, allowed die-cutters to have identical dies from one master punch (*NC*, 1922, pp. 18-22 ; 1963, p. 221). The positive impression could also be impressed, while the bar or punch carrying it was hot, on a piece of hard wood. The latter could then possibly serve the purpose of a die (*ibid.*, 1922, p. 2). It is difficult to ascertain whether the system of hubbing was known to ancient Indian mintmasters.
50. *NC*, 1963, p. 221.

The obverse and reverse dies were now fit to be used in a mint. One of them was fixed on or embedded in an anvil. The other die was attached to (or engraved on?) a (square or an oblong shaped?) punch.[51] Each metal blank was heated or was slightly softened by annealing (to make its hard material ready to receive the required impressions) or was left cold. The blank was then set on the die fixed on the anvil and the die-end of the punch was placed on it (i.e. the blank).[52]

The fact that the reverse type on numerous die-struck coins is found double-struck and/or partly out of flan does not at least indicate a regular use of any mechanical instrument (like a hinge connecting the two dies)[53] to keep the upper die in proper place during the time of minting. Nevertheless, a regular alignment of the obverse and reverse impressions on a great number of coins suggest that care was at least sometimes taken before striking to put the upper and lower devices parallel to each other.

The actual striking seems to have been done with the help of a hammer. After placing the die-end of the punch on the cold, or annealed or incandescent blank already set between the anvil die and the punch-die, other end of the punch was struck with a hammer. As a result both sides of the blank received the required impressions and it was transformed into a coin. A recent experiment in Greek minting technique reveals that two blows of the hammer were sufficient to give full impression of both the dies on the flan.[54]

Several coins, scrutinised under microscope, show homogeneity or near homogeneity in size of the grains of their metal.[55] This indicates that even if the coin was cold worked, the cast metal of the blank was heated and worked out (as indicated above). Or we may presume that a cold worked coin was heated to a high temperature to remove the strain sustained by its metal at the time of striking.[56] At the time of heat treatment a good amount of recrystallisation could have taken place making the metal quite homogenized from the point of view of size of its grains.[57] The same effect could have been achieved by striking the blank at a high temperature.[58] But the hot-working could have affected the die-life.

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[51] G. Macdonald, *op. cit.,* p. 62 ; C. Seltman, *op. cit.,* pp. 21, 22.

[52] G. Macdonald, *op. cit.,* p. 66 ; S.K. Chakraborty, *op. cit* , pp. 21-22.

[53] That Roman mints used hinge "is proved by the discovery, in Gaul, of an obverse and reverse die of Constans I, still so connected. Alternatively, the upper die might be so constructed as to fit on to the lower one like the lid of a box, as is the case with a pair of dies of Faustina Junior, now in the Lyons Museum" (G. Macdonald, *op. cit.,* p. 66 ; *Cortolla Numismatics,* 1906, p. 178f).

[54] *NC,* 1963, p. 226.

[55] The coins so examined belong to the Indian Museum, Calcutta. These were examined under microscope at the conservation section of the museum.

An examination of a large number of coins apparently intended to be round reveal that only a few of them are exactly circular in shape. It appears that the very method of production followed in ancient Indian mints made it impossible for the true circle to be obtained, since there was nothing to stop the flan from spreading under the blow.[59]

Unutilised space around the full impression of a reverse device can be noticed on a number of coins. This indicates that in these cases the punch-die or the upper die was smaller than the blank set on and covering the face of the anvil-die.

The use of smaller upper die may have originated from the desire for allowing the blank to have enough space to receive the full impression of the reverse device even if there was some oscillation of the punch-die during the time of manually operated production. We should also note that the available evidence in other fields of numismatic research shows that an upper die (trussel die) was less durable than the lower die (pile die).[60] So in a given period a mint might require more upper dies than lower dies. Hence the smaller size of the punch-die could have lowered the cost of production in a given period which would have been otherwise greater than the amount required for manufacturing the anvil-dies.

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56. S. Prakash and R. Singh, *Coinage in Ancient India*, New Delhi, 1968, p. 482.
57. *Ibid.*, p. 481.
58. *Ibid.*, p. 482.
59. There is no evidence of the use of any type of collar around the dies to check the blanks from spreading out. See also H.W.A. Lincear, *Coins*, 2nd edition, London, 1962, p. 25.
60. S.K. Chakraborty, *op. cit.*, p. 114, G. Macdonald, *op. cit.*, p. 69; T. Hanson, *op. cit.*, pp. 12-43.

As a result of hard striking by the smaller upper die on the blank its outer marginal part outside the area stamped with the relevant device became a little raised. Such concave reverse may be noticed on some coins which have convex obverse.[61]

Defects of various types, as noted above, are, however, not noticeable on a large number of coins of the pre-Gupta and Gupta ages including numerous Indo-Greek, Kushana and Gupta pieces. Many of these can be classed as objects of art.[62] Production of such quality die-struck coins depended on the artistry of the obverse and reverse devices, excellence of the relevant die(s), purity and/or suitability of the required metal, efficiency in technique of minting and will and resources of the minting authorities.[63]

The majority or even all of these conditions remained unfulfilled by the strikers of the greater number of series of specie in the post-Gupta age, when a large number of ruling families did not at all strike coins.[64] We even do not know of coins of all members of all the ruling families of this age, who are credited to have their own coinage.[65] There are reasons to believe that coins were used to be minted by rulers of at least certain dynasties only when there was demand for them in market and then also new pieces were struck often with old familiar types[66] and sometimes even with the names of dead rulers[67] (whose coins had already become popular with the people).[68] Private moneyers were also allowed to mint coins. They were understandably not at

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61. For examples see B.N. Mukherjee, *The Kushana Genealogy*, Calcutta, 1967, pl. VIA, no. 9 ; VIIIA, no. 21 ; *JNSI*, 1956, vol. XVIII, pl. I, nos. 2f etc.
62. B.N. Mukherjee, *Kushana Coins of the Land of the Five Rivers*, Calcutta, 1978, pp. 16f ; *AGPCNI*, p. 20f. For information on striking coins by the Kushanas, see B.N. Mukherjee, "Some Aspects of the Technique of Minting Kushana Coins", *Indian Museum Bulletin*, 1983, vol. XVIII, pp. 22f.
63. In this connection see also *AGPCNI*, p. 10 and 64.
64. *Ibid.*, p. 66, n. 2.
65. *Ibid.*, pp. 65-66, n. 3.
66. "Bull" and "Horseman" devices were used not only by different members of the Shahi dynasty, but also by rulers of other families. The "seated goddess" type of Gangeyadeva influenced the coin-type of several other groups of rulers.
67. *AGPCNI*, pp. 66-67, n. 3.
68. *Ibid.*, pp. 49f.

all keen to maintain the quality of coins and purity of metal. As a result, coins bearing the name of a ruler might have continued, even after his death, to be imitated in gradually debased metal and technique.[69]

This situation explains the hopelessly debased materials used in minting several series of die-struck specie in post-Gupta India.[70] On many coins the figures are ill-executed and even grotesque,[71] obviously due (partly or fully) to deficiency (a) in the merit of the designer, and/or die engraver (or designer-cum-die-engraver), and (b) in the metal of the die, and also (c) in the technique of minting. On a fairly large number of coins an emphasis on delineating only the outlines of the figures in high relief is noticeable.[72] This technique of execution was probably necessitated due to use of poor and alloyed metal and of dies deeply sunk in the relevant places only.[73]

Economic and political factors led to deterioration in the system of coinage, affecting seriously its typological, metrological, and technological aspects. The situation was quite chaotic when the power of Islam became firmly established as the most dominant political authority in the subcontinent in the 13th century A.D.

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69. *Ibid.*
70. *Ibid.*, pp. 39, 41, 43, 49, etc.
71. *Ibid.*, pp. 49, 51f ; B.D. Chattopadhyaya, *Coins and Currency System in South India, c. A.D. 225-1300*, New Delhi, 1976, pl. VI, nos. 317, 319 and 312 ; pl. V, no. 354 ; etc.
72. *AGPCNI*, pp. 43 and 53 ; pt. XVII, nos. 5-12 ; pl. XXXVII, nos. 9f ; pl. XII, nos. 14b.
73. *Ibid.*, p. 43.

Appendix III

The Impact of the Introduction of Iron on Material Culture in india
With Reference to the Formation of States

N. R. BANERJEE

I. INTRODUCTION

In the sequence of human technological development the Iron Age follows the Copper-Bronze Age, itself the successor of the Stone Age, Nevertheless, the words Iron Age do not connote the same or a uniform chronological horizon throughout the world. Nor is there a consensus on what constitutes the Iron Age.

As regards the criteria of the definition of the Iron Age, a working hypothesis has been suggested by Anthony M. Snodgrass. According to the norms indicated by him the Iron Age constitutes or is distinguished by "working iron", that is, iron used to make the functional parts of the real cutting and piercing instruments that form the basis of early technology. This criterion envisages "three broad stages in the development of iron technology". In *Stage 1*, iron may be employed with some frequency "but its main employment is for ornament". In *Stage 2*, "working iron" is present but is used less than bronze for implements of practical use. "In *Stage 3*, iron predominates over bronze as the working metal, although it need not, and usually does not, completely displace bronze even in this role". Naturally as well, each of these stages relates to a time-scale which is held as valid broadly for every area of Eurasia, especially for the Mediterranean. The time brackets suggested for the three periods are as follows :

(1) Bronze Age Stage 1	Before 1200 B.C.
(2) Stage 2	1200-1000 B.C.
(3) Stage 3	1000-750 B.C.

Nearer home, in western *Iran*, the corresponding period divisions are as follows :

Period I	1450/1350-1100 B.C.

Period II	1100- 800 B.C.
Period III	800- 500 B.C.

At the same time two other criteria have also been suggested as yardsticks for the shift over to the two relevant stages, and these comprise the application, or a degree thereof, of the technological processes of carburization, quenching and tempering in the making of an object.

While the earlier criterion would surely have validity in the Indian context, the data in regard to the second criterion are so meagre that its inclusion for the present would preclude any meaningful discussion on the Indian Iron Age, and has, therefore, to be discounted for the present.

The beginning of the Iron Age *per se* is considered to be the date of its first emergence in any geographical area. From this point of view the Indian Iron Age would begin at *c*. 1300 B.C. on the basis of the slender evidence at Ahar and Noh in Rajasthan, and somewhat later at Nagda, in Madhya Pradesh and Prakash and Bahal in Maharasthra. It may however be stated that it was about the time of the Mauryan empire that iron had come fully into its own and its impact was first fell fully. For the time frame for the development of the Iron Age in India the following sub-divisions are considered as will be shown below.

(a) 1300-1000 B.C.
(b) 1000- 800 B.C.
(c) 800- 600 B.C.
(d) 600- 200 B.C.

Of this the first sub-division may for the present be discounted, for the evidence is rather inadequate and not well defined.

While the above cited time bracket is all inclusive it is observed that iron objects, often with traces of local manufacture, occur in seven otherwise mutually exclusive centres in the Indian subcontinent. They are summarily enumerated below :

(i) Baluchistan and north Western region,
(ii) Northern region (Kashmir),
(iii) Rajasthan,
(iv) Malwa and northern Deccan,
(v) The Indo-Gangetic Divide and the Ganga-Yamuna doab upto the confluence at Prayag,

(vi) Eastern India covering Bihar and West Bengal, and
(vii) South India including the Deccan and peninsular region, respectively.

The north-western and *Baluchistan region* is represented by the recent discoveries of the Gandhara Grave Culture in Swat, the iron bearing horizon at Pirak in Baluchistan, and the older known cairn burial sites at Zangian, Jiwanri, Gatti, Moghul Ghundai and Nasirabad. There is no *inter se* homogeneity in the iron-affected cultural milieus of these areas, though there is a near-consistency of dates, namely, 900-600 B.C. for the Gandhara Graves, 800 B.C. for Pirak, and a still later date bracket say 800-400 B.C., for northern India in general, though the firm dates of the cairn burials are of indeterminable nature. K.C. Ramachandran in a recent study has suggested a date bracket of 6th-5th century B.C. to 7th Century A.D. (1974).

The *northern region* in India is represented by the iron horizon at Gufkral in the Kashmir valley which has been dated to *circa* 1000 B.C. and has a distinction of its own.

Rajasthan is represented by the iron bearing horizon at Ahar, on the outskirts of Udaipur, in a late or post-chalcolithic milieu and dated to *circa* 1300 B.C. as well as at Noh, near Bharatpur. Malwa and northern Deccan are represented by the evidence of iron objects in Period II at Nagda, in a mixed late chalcolithic context, and datable to *circa* 1200 B.C. on the basis of the dates of the end phase (1200 B.C.) of the chalcolithic culture in Malwa which it succeeds after a short gap. The evidence from Prakash and Bahal in Maharasthra, in the northern Deccan is comparable and together they lend support to the chronological position stated above.

The Indo-Gangetic Divide and the doab are dominated by the iron-bearing Painted Grey Ware horizon as the earliest of the iron age culture complexes in the northern Indian area. Though there is a broad acceptance of a date bracket of 800-400 B.C. for this cultural complex the isolated date from Atranjikhera, Dt. Etah, in U.P. would point to the possibility of a date of 1115 B.C. for the beginnings of the horizon at this site.

The evidence from Chirand and Sonpur in Bihar, and Pandu Rajar Dhibi, Mahishdal and Tulsipur in West Bengal indicate a post-chalcolithic and pre-N.B.P. date for the emergence of iron in these areas. A date around 800-700 B.C. would probably be appropriate for this phase in eastern India.

South India, comprising Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala, and the iron-bearing cutural horizon in the area are represented by the large numbers and varieties of megalithic funerary and commemorative monuments strewn all over this extensive region. The chronological expanse of this culture has been inclusively found to range from *circa* 1000 B.C., if not still earlier, in an interlock with the end phase of the underlying neolithic-chalcolithic culture as demonstrated at Hallur, Dt. Dharwar, Karnataka, though a date of range of *circa* 1100 B.C. to the period of the beginnings of the rule of the Satavahavans in the 1st Century B.C. has been claimed for this phase. These are the inclusive dates, and they are by no means characteristic of all the megalithic remains in the extensive areas of south India.

It is idle to go into the question of the source or sources of the coming of iron into the subcontinent in spite of what has been stated in the past. It has now become apparent that the evolution is not unilinear, and is *not*, therefore, diffusionist. It has been demonstrated by K.T.M. Hegde that the smelting of iron and the manufacture of iron objects in India evolved out of the earlier established metallurgy of copper. Since the copper mines were concentrated in the Khetri area of Rajasthan, near Jaipur, the evolution of the metallurgy of iron may have evolved in a contiguous area, and the evidence of the early occurrence of iron together with copper at Ahar points in this direction. Whether the new-found knowledge spread from this area as epicentre is more than any one can say. That Rajasthan was a crucial area for the emergence of copper-metallurgy has been amply demonstrated by the extensive evidence at Ganeshwar in District Sikar in a pre-Harappan context at the latest.

The archaeological evidence on smelting and smithy of iron during the period under review is so far meagre. But the evidence found at Naikund, near Nagpur in the megalithic context, of a cylindrical furnace with tapering sides broader at the base and narrower towards the top, with a passage at the bottom on one side for the nozzle of the tuyere of the bellows, and a passage for the flow out of slag at the other is remarkably close to the practice followed until about 20 years ago by the iron smelting Agarias of Chhota Nagpur plateau near Ranchi in Bihar. It is significant and indicative of the long life and persistence of the traditional method. Ujjain in Madhya Pradesh has yielded the evidence of an iron worker's workshop of the N.B.P. period, i.e., 600-200 B.C. The evidence of smelting iron ore (limonite) with the use of a flux of calcium carbonate (calcite or aragonite) in a circular based furnace dug into the earth from the same levels points to the general nature of iron technology in this phase of the Iron Age. The process, inferably of repeated heating and hammering and the resultant impregnation of carbon led to the production of case hardened mild steel. It is, therefore, not for nothing that India enjoyed a reputation for her steel or iron from the days of Herodotus.

The wootz steel which was being produced especially in south India till the advent of the British in closed cylindrical crucibles containing iron ore with an admixture of carbon was high quality mild steel, and was much in demand in the west. The literary evidence of the popularity and demand for Indian iron or steel is too well known to deserve emphasis.

The well known rust free iron pillar of the fourth century A.D. installed in the quadrangle of the Quwat-ul-Islam mosque at Mehrauli, near Delhi, is the culminating example of a technology of forging, of a pillar in this case, section by section, of almost pure iron (99.97%) that must have had a hoary antecedent.

Notwithstanding the early break-through in technology, we have to examine if the products of the new technology brought about significant changes in the life patterns of the affected people or their material culture. Speaking in terms of the impact of iron in the Painted Grey Ware levels in the Indo-Gangetic Divide and the doab, the late A. Ghosh, formerly Director General of the Archaeological Survey of India, stated as follows : "No doubt, in a slow moving society the impact of iron was slow. The metal did not produce any spurt in the material prosperity of the society". He also expressed the view that it would be wrong to emphasise that the occupation of the Ganga plains (by the users of the Painted Grey Ware pottery) could not have taken place without iron. He believed that copper-bronze equipments, *if available in the required quantity*, would have done the job equally well *though more slowly*. The less toilsome method of getting rid of a jungle by burning it, as was usually done, could as well have delivered the goods. Ghosh is not wrong in his estimation.

It may, however, be pointed out that since copper bronze equipments were not available in the required quantity, and since iron was more abundant in supply and may or must, therefore, have been used instead points to its utility and impact, which could not be lost upon those who had employed iron tools in their daily lives. It was, in fact, the paucity of tin in India that had led to the development of iron. Though tin occurs in the Aravallis (Rajasthan), in Gujarat, Karnataka and Bihar, the deposits are considered as "too small to be economically significant". The realisation of the ease and faster pace of work that iron rendered possible could not be missed and could not but have had an impact on material life. The compulsion of territorial expansion which could have been either a pressure from other folks or a growth of population, meaning a larger number of mouths to feed, led invariably to activities devoted to the increase of food production and eventually even to the growth of a surplus besides of course territorial expansion to "fresh fields and pastures now". This in turn led to diversified activities, and proliferation of crafts and trade etc. and widening of the pattern of life.

In contrast to Ghosh's view, suggested for a later period, Professor R. S. Sharma stated, "The primary factor that revolutionized the material life of the people around 700 B. C. in eastern U.P. and Bihar was the beginning of the use of iron". The increased use of iron in the subsequent period points to the correctness of this inference.

II. ASSESSMENT OF THE PATTERN OF LIFE IN THE DIFFERENT IRON AGE CENTRES AND IMPACT OF IRON

(i) *Baluchistan, Makran and North Western Area*

The cairn burial sites constitute single culture sites and there is hardly any scope for comparison with what went before and after. The iron objects are not clearly defined in all cases.

Those in Moghal Ghundai comprised leaf-shaped arrow-heads, arrow-heads with small points, a triangular barbed arrow-head, knives, daggers and other objects of indeterminate use. Most of these objects had a tang for hafting. The iron objects at Jiwanri comprised a thick iron hook and scraps of iron. The only other notable object, from Zangian, was a sword blade, and an iron weapon with bronze fastening.

Thus the main objects are weapons of offence, defence, hunt and chase, though the knives also indicate domestic use.

The people perhaps depended less on agriculture than on the hunt and chase, and rearing of animals including the horse, and the iron tools or weapons would surely have enabled them to make their activities much more efficient than otherwise. There is no indication of any large habitation, not to speak of any traces of urban life. It cannot also be stated if they manufactured the iron objects they needed, or obtained them in exchange for some goods, and, if so, with whom and with what articles of trade. But the chronological horizon is not clearly established.

(ii) *Pirak*

Pirak in Baluchistan is the only excavated habitation site of cairn-burial people, and the earliest excavated level containing iron has been dated to a date before *circa* 800 B.C. The evidence of iron objects in the subsequent period is not substantially different from that in the burials, though the number of iron objects is on the rise. The scope of its influence on contemporary cultures elsewhere is circumscribed as much by geographical factors as the inherent inadequacies of the culture itself, though the pottery bears the stamp of Iranian influence and is sophisticated.

(iii) *The Gandhara Grave Culture*

The Gandhara Grave Culture, so called by Dani, presents, however, a different picture. This culture has been found in a number of sites in the Swat valley of Pakistan, namely Katelai I, Loebanr I, Timargarha, Barama, Butkara II, and Balambat (a habitation site). The culture is characterised by post-exposure fractional burials, iron objects and skeletal remains of the horse, besides grey pottery. The date of this cultural horizon is 900-600 B.C. It is difficult indeed to trace the impact of iron on this culture except of course the use of the horse and its control through snaffle bits of iron as found at Timargarha (Swat Valley of Pakistan). Such a control made the people master of a hitherto unknown spurt in their mobility, whatever that may mean. The other objects comprising spear-heads, flat rectangular axes, nails and spoons are scarcely impressive. The limited distribution of the sites contraindicates any potent force of far-reaching consequences.

(iv) *Kashmir*

Kashmir—The full report of the excavations at Gulkral is yet to be published. A discussion of the difference made to the pattern of culture as a result of the impact of iron, is, therefore, precluded.

B. *Rajasthan*

The primary evidence in this region comes from the chalcolithic levels of Ahar, the end of which has been dated to *circa* 1490 B.C. or to 1300 B.C. This phase has been shown to produce about a dozen objects of iron. This period is succeeded by a dubious hiatus before the next occupational phase in the early historical period. A similar evidence has been observed at Tilwara and Bagor also, where iron occurs in a microlithic and chalcolithic context. Beyond indicating an early date for the emergence of iron in this region the evidence does not point to any impact.

The fragmentary evidence at Noh of the find of an indeterminate object, in the black-and-red Ware levels, below the Painted Grey Ware, in a chronological context of 1100-900 B.C. does not go much beyond indicating the antiquity of iron in this region.

The pattern of evidence of the occurrence of iron in the black-and-red ware yielding levels before the beginning of the early historical period is repeated in several other sites, namely, Somnath (III), Nagar (II) and Timbarwa (I) in Gujarat. They only point to an earlier level for the occurrence of iron which would not recede earlier than 1300 B.C. The objects themselves are dominated by the arrow-head, while the others include chisels, axes or adzes, sockets, nails, rings and pegs. A fairly large number of slags indicate local manufacture implying a well entrenched iron industry at Ahar. Though they interlock with the earlier chalcolithic culture, the association of the N.B.P. Ware makes the chronological position uncertain, if not dubious, and they need not detain us.

C. *Malwa and Northern Deccan*

A very large body of evidence of iron comes from period II, i.e., later levels of the chalcolithic culture of *Nagda*, Dt. Ujjain, Madhya Pradesh. If the end phase of the chalcolithic culture is considered to be around 1200 B.C., this evidence at Nagda would be all of a piece with the evidence at Ahar. The objects, the "working tools", of iron here comprise spear-heads, arrow-heads, chopper or celt, knives, blades, rings or clamps for fastening tools, possibly also an axe of the socketed type indicating a much wider range of activities than the microlithic blades, or flimsy kohlsticks and other such objects of indeterminate shape and use would suggest. Apart from hunt and chase, crafts of the carpenter, the smith, and the house-builder are indicated. The agricultural practice was no doubt carried out with digging sticks that may have had iron at its tip and circular ringstones or maceheads for the top as weights. Life in general was richer and more variegated and perhaps sophisticated, judging also from the variety of mirror-like polished ear-ornaments of stone discs etc.

All this arose presumably from a higher sense of security and proliferation and diversification of crafts that the use of iron indicates. There is, however, no sign of urbanization as yet.

At *Prakash*, Dt. Dhulia, Maharashtra objects of iron have been found in fair abundance alongside copper in Period II, which is post-chalcolithic but is associated with the black-and-red and the N.B.P. Significantly, iron occurs throughout the 17 ft. (5.10 m.) thick deposits. The excavator himself has stated that "The beginning of Period II may be placed somewhere towards the close of the seventh century B.C. with a margin on the earlier side". In the context of the current evidence on the dates of iron in this area this could be extended to *circa* 1000 B.C., if not still earlier. The objects of iron prior to the occurrence of the N.B.P. Ware comprises among others a tanged arrow-head, a celt-like axe-head, a lance-or spear-head, a knife blade, a chisel-ended tanged object, possibly a carpenter's tool and a ferrule, respectively. The excavator goes on to add that "The use of copper became more common" (i.e. than in the earlier chalcolithic horizon of Period I), "though remaining subordinate to that of iron". It is significant to observe that the copper objects of the Period consisted of bangles, rings, antimony rods, and a lid possibly of a casket. Thus here again iron was the "working tool" and encompassed a much wider range of activity than mere stone tools or copper objects would command. Iron did indeed usher in a much more variegated life than in the earlier period, if not leading as yet to urbanization. Nevertheless, the base of agriculture appears to have been strengthened.

Eran, Dt. Sagar, Madhya Pradesh has yielded a comparable evidence of the occurrence of iron objects in a pre-N.B.P. Ware level associated with the black-and-red ware, which shows continuity with the earlier chalocolithic Period (I). The end phase of the chalcolithic period has been dated by Carbon 14 to *circa* 1045-955 B.C. Thus the date of iron in this area, occurring in a phase of interlock between the two cultures, would recede further around 1000 B.C. The rudiments of urbanization may phrhaps be traced to the remains of mud fortifications believed to have been constructed towards the middle phase of the chalcolithic occupation, which began around 2035-75 B.C. But this, regardless of its import, was achieved without the aid of iron. The impact of iron in the succeeding phase is not clearly indicated.

D. *The Indo-Gangetic Doab*

The Indo-Gangetic Divide and the *doab* are one of the two most richly documented Iron Age Cultures in the sub-continent. It has two phases, the earlier of which is distinguished by the Painted Grey Ware ceramic and its associates, and the later by the N.B.P. Ware. The earlier phase can now be safely dated to between 900-400 B.C., and the latter to 600 to 100 B.C. with an obvious overlap between the two. K.N. Dikshit has pointed to the probability of the end phase of the Painted Grey Ware going up to 600-300 B.C. (1977-78).

The Painted Grey Ware has an extensive geographical distribution bounded by the foothills of the Siwaliks in the north-east, the river Satluj in the north-west, the Aravallis in the west, the Chambal in the south, enclosing in the main the ancient Saraswati and Drishadvati valleys, or *Brahmavarta*, or *Aryayarta*, the Indo-Ganga Divide and the Ganga-Yamuna doab up to the confluence of the Ganga and Yamuna at Prayag.

Recently many Painted Grey Ware sites have been found in Pakistan, which would perhaps extend the frontiers of the ware and associated cultural traits further afield towards the north-west.

B.B. Lal identified the above mentioned areas, namely the Gandhara Grave Cultural horizon and the Painted Grey Ware culture regions are the early and later homes of the Aryan-speaking people on the triple criteria of space, time, and cultural contents in a paper on "The Indi-Aryan Hypothesis Vis-a-Vis Indian Archaeology" presented at an Indo-Soviet seminar on "Ethnic problems of the Early History of the Peoples of Central Asia and India in the Second Millennium B.C." held at Dushanbe, USSR in October 1977. He also conceded the claim of the Gandhara Grave culture of Swat to be an offshoot of a common Indo-European people living somewhere arround the north-eastern part of Iran. But the Gandhara Grave culture could not immediately be correlated with the so-called Painted Grey Ware Culture.

At the same time it may be recognised that claims have been made for the good candidature of the Gandhara Grave Culture, the earliest date of which goes back to the 16th-13th centuries B.C., for identification with the Rigvedic Aryans. It was Period III of the Gandhara Grave Culture (9th-6th centuries B.C.) that yielded iron objects and remains of horse, and horse furniture, that is of relevance in this context.

In this connection attention may be drawn to the comparatively recent finds of an earlier level of the Painted Grey Ware at Bhagwanpura, Dadheri, Kathpalon and Nagar in Haryana and Punjab without any iron. The level dates back to 1500 B.C., and interlocks with the late Harappan Culture.

The important sites where iron has been found associated with the Painted Grey Ware are Ahichchhatra, Hastinapura, Alamgirpur, Sravasti, Atranjikhera and Kausambi in Uttar Pradesh, Noh in Rajasthan and Supar in Punjab. Kausambi represents the easternmost expanse of the Painted Grey Ware in its decadent stage.

The iron objects in general comprise spear-heads, arrow-heads, blades, rods, pins, nails, ring, knife, leaf-shaped points, socketed tang (for tools of indeterminate shape) axes with broad cutting edges, sickles, tongs, chisels, borers, needles and bangles etc. These may be classified as (i) hunting tools, (ii) weapons of offence and defence, (iii) agricultural tools like the sickle or the axe, and (iv) carpenter's or builder's tools, and (v) household objects respectively. As against these the repertoire of copper objects in the period comprise small quantities of antimony-rod-nail parer, nail parer, pins, bangles, rings, fish hooks, celt, clamps, and dishes etc. from Atranjikhera and a copper arrow-head and a borer from Hastinapura. It is apparent, therefore, that iron had become the "working tool" in the period though the older established tradition of copper, no longer dominant, but considerably subdued, continued in a subordinate role. Nevertheless, the paucity of agricultural tools even in the more utile or ample metal cannot but be an arresting factor, though in mitigation it may be advanced that the paucity of excavations, and considerably more wear and tear, may account for the negative evidence, for it cannot be denied that much larger areas were brought under cultivation, the principal cereal being rice. It has been inferred by K.A. Chowdhury that there was a surplus of food grains especially rice, at Atranjikhera, though barley and wheat were also cultivated, the latter new crops in the area. It has been postulated that irrigation was caried out not merely with well water (*Kupas* being mentioned in the *Rigveda*), but also by means of irrigation channels mentioned in the *Rigveda* which could be dug efficiently with iron tools (*Khanitrima*) as pointed out by B.N. Puri. In the absence of archaeological evidence, scarcely likely to be found, as they would be near the fields and sources of water, the inference can be termed as a probable surmise. The surmise gains ground from the fact that many of the sites are at quite some distance away from the river banks, and had but to depend on artificially made sources of water. The find of a spade and a crowbar of iron in a rusted and decadent state in the make-up of the pre-N.B.P. mud rampart at Ujjain together with impressions of wicker work baskets for carrying earth points to the possibility of such activity. The wood used in the palisade of Ujjain, also of the same period, namely, *Khair* (*Acacia ferruginea*) is very hard, and would have required efficient metal equipments of either bronze or steel, and the cutting edge of the tool must have been at least as wide as 9.5 cms. as is indicated by the cut marks. Bronze having almost gone out of fashion it can only be surmised that the "working tool" in this case must have been of steel.

D.K. Chakrabarti has traced the use of iron for agricultural purposes in the upper Gangetic valley to as early as 700 B.C. with a margin extending up to 800 B.C. (1979).

Though most of the P.G. Ware sites appear as village sites, we may not necessarily judge them by present day standards. In spite of the wide expanse of the Harappan civilisation or empire, not all the sites can claim the metropolitan aspects of Harappa, Mohenjodaro, Lothal, Kalibangan and Surkotada. Neither are the sizes of the upper and lower areas within the Harappan complex very impressive. For instance, the ancient fortification of Ujjain did not measure more than 1.60×1.20 km. in size, yet literature described it as *visala* (large). As a parallel case, the instance of a large P.G. Ware site covering 13.7 hectares among a group of 14 small P.G. Ware sites found by R. Moghal in Pakistan, of which a group of four average between 1.1 and 2.1 hectares, while three are less than a hectare each, and the rest which fall between 3 and 4 hectares may be mentioned. This evidence certainly gives rise to the idea of the rise of a chief town, as rightly suggested by M.D.N. Sahi. Further excavation alone may clinch the issue. But the trend towards urbanization, may be in a rudimentary form, is clearly established.

E. *Eastern India*

The evidence from Chirand and Sonpur in Bihar, and Pandu Rajar Dhibi, Mahishdal, Barudih and Tulsipur in West Bengal, shows the occurrence of iron associated with a black-and-red ware ceramic, plain or painted, before the levels of the N.B.P. Ware. At Chirand it occurs in a late phase of the chalcolithic culture following the still earlier neolithic culture in succession. The evidence of Chirand and Sonpur are comparable. The level has been dated on the basis of Carbon-14 data to *circa* 700 B.C. But the objects themselves were not such as to suggest a radical change in the way of ilfe. The dates of all these sites are similar, and contain the usual assemblages of tools such as spear-heads, arrow-heads, indicating hunting and chase, if also self-defence, and chisels. As in the case of the Painted Grey Ware sites, there is evidence of local manufacture of iron objects in the form of slags. Thus it may be stated that the settlements were largely rural with a solid base in agriculture, though it should be admitted, from the evidence of local manufacture of iron objects, that they may have served as satellites to an as yet elusive and distant metropolitan centre, indicating the rudiments of urbanization. Iron must have strengthened the agricultural base of the prosperity of the countryside, though the absence of the ploughshare *per se* is an inexplicably disturbing phenomenon.

R.S. Sharma has cited literary evidence from the *Atharvaveda*, to indicate the use of hard *khadira* wood ploughshare tipped with metal, no doubt iron, during the period in the Ganga plains for use in cultivation. Sharma has also drawn attention to the mention of four, six, eight, twelve and twenty-four oxen being yoked to the plough in the *Atharvaveda* and other texts of the times to break the hard soil for the purposes of cultivation. Iron, inferably, had a role in this arduous if not impossible task. It is also to be noted that none of the repertoire of copper hoard tool types of the preceding period, except perhaps the celt, can be called an agricultural tool, implying preference for fishing, hunting and chasing. In this context it may be stated that the copper objects included in the 'hoards' are chronologically prior to the Painted Grey Ware horizon.

Generally speaking, the specific agricultural tool, namely, ploughshare, either in copper, bronze or iron has not so far been found in the excavations. The recent find of a terracotta figure about 15 cm. in size in the shape of a ploughshare, with a pointed tip, in the form of a pierced rod for fixing the yoke, and a handle in the Harappan levels at Banawali gives an idea of what the Harappan ploughshare may have been like. As a terracotta figure it may have served as a prototype of the real thing which may have been of hard wood, for some agricultural ritual. In Tamilnadu on the occasion of *Pongal*, the harvest festival, it is the plough that receives worship as the principal tool of the means of sustenance. It may also have served as a toy, though by itself it does not appear to be attractive enough for a child. A comparable object, though partially damaged was reported by E. Mackay from Mohenjo-daro. It is now in the Prince of Wales Museum. The absence of any metallic plough from among archaeological finds would lend support to R.S. Sharma's inference that the ploughshare even in the later Vedic period must have been made by hard wood tipped with metal.

F. *South India*

The discovery of a couple of heavy iron objects of boat shape with a longer and pointed end and a shorter and blunter end, at Ramapuram in Dt. Kurnool, Andhra Pradesh in what has been described by K.V. Soundara Rajan (1979-80) as the transitional photohistoric to Iron Age, i.e. 1000-600 B.C. megalithic complex, indicates the probable broad shape of the iron ploughshare of the megalithic people.

The entire area is distinguished by a large number of megalithic monuments with enormous interments of iron objects along with a plethora of pottery, occasionally gold and silver objects, besides copper and bronze, indicating considerable development of metallurgy. But the habitation sites discovered so far are much smaller in number than the burial sites. The folks knew the use of horse and were in fact so found of them that they were also buried along with their decorative accountrements and the human remains of the dead. The paucity of habitation sites has led some scholars to surmise that they were nomads and rearers of domestic animals like the cattle, sheep, goats, pigs, fowl, horses and the dog. But the communal nature of their funerary monuments, the compulsions of the prior exposure of the dead in maceration pits or altars, and needs of affording protection to their large flocks of domestic animals would be contra-indications against the nomadic theory, though there cannot be any denial of the existence of skilled ironsmiths and artisans among them who catered to their variegated needs.

The objects of iron by and large consist of long javelins or spear-heads, arrow-heads, axes, chisels, longitudinal spade blades with diagonal straps, bars, rods, ferrules, horse bits ; and each grave has several dozens of them. These were no doubt locally manufactured, as indicated by a furnace at Naikund, already referred to earlier. It is to be noted that the furnace site, occurring in juxtaposition to a habitation-cum-burial site, is yet located at a distance of 200 metres from one and 130 metres from the other. As the most obnoxious carbon monoxide is emitted by smelting activity this evidence too would be a contradiction against the nomadic idea.

The megalithic people, despite the wide variations in the morphology of the monuments, relatable to changing topography as well as to differences in the modes of disposal of the dead partook of a near-homogenous culture. They had a strong base in agriculture as their deliberate juxtaposition to large natural hollows in the land serving as irrigation tanks as their large-scale production of rise would indicate. As regards the ploughshare there is no evidence except the two pointed heavy objects from Ramapuram in Dt. Kurnool, A.P. Yet they did not build large metropolitan centres but preferred to live in village communities, nor to form any large kingdom or state till Asoka's incursion into their seclusion leaving out only a small area in the extreme south, comprising the territories of the *Cholas*, *Pandyas*, *Keralaputras* and *Satyaputras* shook them out of their slumber. This, however, does not take into account the kingdoms or territorial units that arose in the Deccan and peninsular India towards the middle of the first millennium B.C. This again shows that the mere possession of iron did not necessarily lead to urbanization, nor an amplitude of agricultural products lead to an organisation to serve as the basis of a city or state.

The late H. Sarkar (1978-80) has drawn pointed attention to the presence of many different racial types among the megaliths, probably accounting for differences in the burial types. The presence of different racial strains in juxtaposition may have stood against a spirit of cohesion.

These types comprise (1) hyperdolicho-cranial, (2) dolicho-cranial, (3) meso-cranial, (4) brachy-cranial and (5) hyper-brachy-cranial forms, respectively. It was also observed that the brachy-cranial and hyper-brachy-cranial are absent in the jar burials. Sarkar concluded that the real megalithic monuments are perhaps connected with a meso-brachy-cranial people who might have migrated from West Asia by about 1000 B.C.

However it may be stated that the megaliths of Vidarbha as revealed by the excavators are detable to *circa* 700 B.C., being somewhat later than the megaliths of the further south areas.

The Formation of States

The N.B.P. Ware and the associated cultural complex that evolved between 600 and 100 B.C. and covered a much more extensive area than the Painted Grey Ware, witnessed the real advantage and flowering of the Iron Age in India. First of all the new complex marked the emergence of fortified cities as the capitals of at least 16 *Mahajanapadas* or kingdoms and republican confederations as states in northern India as the literary evidence of the Buddhist *Anguttara Nikaya* indicates. This was made possible by the continued development of agriculture, diversification of craft and industries and no doubt the emergence of leaders of extraordinary talent. Iron did play a role in this phenomenal development, for, iron by this time had totally replaced copper objects as "working tools". If, however, they could manufacture enough copper or bronze objects, and iron metallurgy had not developed, their progress would not have been slower. But the profusion of iron served the purpose of clearing the jungles fast enough and could equally intensify agriculture. It also enabled the development of equally effective weapons of warfare, to be used as much for offence as for defence. Fortified cities sprang into existence, and roads began to be built to account for the movement over them of carts with a universal guage of 5′9″ (1.75 mm.), as evidenced at Ujjain during the period. The needs of keeping accounts of trade and of administrative matters led to the evolution of the script. The Asokan inscriptions engraved on rock surfaces or on the surfaces of well carved pillars are administrative and archival documents of the highest significance. The quarrying and carving of the sandstone pillars were made possible by the development of highly efficient tools now made of steel or iron. The carving out of caves, such as those of the Barabar hills near Gaya is also to be traced to the same efficiency of tools. The artistic and sculptural carvings on the capitals of the pillars were the direct outcome of the use of the profusely available tools of steel or iron.

The period also witnessed the emergence of *coins* in the form of punch-marked strips, square or rectangular, of silver and copper, to account for the increase in the volume of trade and commerce. This is also reflected in the terms of *karshapana* or *pana* mentioned in Panini's *Astadhyayi* of about the middle of the first millenium B.C.

The ensemble of iron equipments of the period comprise mostly of chisels, drills, axes, knives, clamps, nails, bowls (limited in quantity), ladles with horizontal or vertical handles, daggers or swords, arrow-heads and spear-heads etc.

A more detailed treatment of the cultural life of the people in this period would not be warranted at this stage. Suffice it to say, the increased efficiency of the tools and weapons of iron, its larger production as a result of the discoveries of ores found by deliberate exploration and their more extensive exploitation as a consequence made it possible to clear the wooded countryside, lay roads to connect the metropolitan cities, however few and far between, with the hinterland as well as with the marches or borders of the respective territories, as well as with the other cities, whether capitals, trade centres, places of pilgrimage or port towns and thus bring unknown or little known parts closer together and to make possible rapid dispersal of technological advances and articles of utility, bringing them within the reach of peoples widely separated from one another. A common technological link united peoples over distant regions. It helped a common cultural pattern, in spite of *inter se* diversities, overgrowing its scope and compass with a much quicker process of formation in the wake of the new metal. The process had begun much earlier in the initial stages of the evolution of iron along with the Painted Grey Ware in the crucial heartland of India. The process was accentuated and accelerated during the period of the Northern Black Polished Ware, reaching a climax in the heyday of the Mauryan empire under Asoka (273-232 B.C.). Nearly the whole of India except some parts in the extreme south, and even Afghanistan, as the Asokan inscription of Kandahar tells us, were absorbed in the empire. Is it not amazing to observe that Asoka could have his edicts composed in the language or script suited to the peoples in whose midst they were installed and take up many public works including irrigation tanks, and hospitals for men and animals and exceptional arrangements for the movement and storage of grains in times of famine by royal decree employing quick communication and transportation and efficient vehicles, with a long antecedent. The sheer logistics of warfare, particularly the dreadful war on Kalinga, and the movement of the armageddon from and to the headquarters and the transport of a hundred thousand prisoners of war to the imperial capital indicate a considerable background and a time-lag for preparation. The despatch of missionaries to the five western kingdoms also indicate prior knowledge of their existence and acquaintance. Much ground for this must have been covered by Megasthenes during the time of his grandfather, Chandragupta Maurya. It appears that the first Mauryan king had blazed a trail across the subcontinent and had succeded at a stroke to sweep away the vestiges of innumerable small states and weld them together into a well knit empire with an in-built system of regional administration through governors or viceroys. The index may have come as much from Kautilya, whose *Arthasastra* with a much older tradition of the theme is a supreme testament of administrative principles and practice, as from a sense of injured pride resulting from the humiliating defeat of Porus (Puru) at the hands of Alexander, the invader from Greece. The memory of Darius's conquest of the northwest frontier, which was made a part of the extensive Persian empire and set up under a provincial ruler or satrap of the 20th satrapy or a component unit of the Persian empire in 521 B.C. was still rankling in the minds of the people. The ease with which the nearly two hundred year old Achaemenean hegemony over a part of India was terminated by Alexander about 330 B.C. through superior strategy could not have been lost upon young Chandragupta, then an obscure soldier. The manner of winning over Porus, not merely with superior strategy, but the diplomatic stratagem of isolating and weakening him, was keenly observed by him. An empire was swiftly founded over the ashes of a multitude of states (the *Mahajanapadas*).

The role that a network of roads for quick communication and marching of the army played in the building up of an empire towards the end of the fourth century B.C. cannot be overremphasised.

It was the extensive use of versatile iron or steel (it may be observed that Alexander accepted a gift of 100 talents or 30 lbs. (barely 15 kg.) of steel from Porus after his victory over the latter in 326 B.C.) that must have made this phenomenon possible. What the tools did for the roads, the arms of iron or steel did for the soldiery. Can the role of iron then be overemphasised in the formation and consolidation of states during the period around 650-300 B.C. ?

It may be observed that long before the time of the Buddha ascetics and monks, variously named as *Ajivikas* and *Jatilas* etc., went about the country with begging bowls. They were economically unproductive and yet they subsisted and flourished. It was the Buddha who rationalised the institution and founded the *Sangha* of monks and nuns who lived on the charity of the society which could spring forth from a surplus of grains, the mainstay of life (as borne out by the archaeological evidence at Atranjikhera in District Etah, U.P.). If the tradition of 24 Tirthankaras among the Jains and of 24 previous Buddhas were true, the life of the tradition of the surplus would be much longer. In this context the statement cited earlier of Prof. R.S. Sharma can be easily understood. The paucity of copper and tin as compared to iron, and the abundance of the latter which led to a technological effiorescence made all the difference to an economy based on tools of steel or iron.

III. CONCLUSION

The most crucial contribution of the increased use of iron, especially, in the developed phase of the Iron Age in India, namely, 600-100 B.C., was the fillip to urbanization and building of fortified cities culminating in the conquest of the *Mahajanapadas*, and their eventual coalescence into a single large state with a centralised administration at the time of Asoka in the third century B.C. It is not to say that the idea of kingdom, howsoever small, and of "towns" or "cities" was not known during the intervening period after the end of the metropolitan cities of the Harappan period. The archaeological evidence of the fortified city of Ujjain and Kausambi would easily go back to *circa* 600 B.C., if not still earlier, even if the evidence of the ramparts of the chalcolithic period at Eran or at Nagda is to be rejected. For another, we have a mass of literary evidence, of the *Brahmanas* and *Upanishads*, attributable to the period 900-600 B.C., which point to the emergence of a large number of states throughout India. To cover the evidence briefly, it may be stated that the *Brahmanas* and *Upanishads* bring to light the existence of ten States in northern India. These comprise (1) Gandhara (2) Kekaya (3) Madra (4) Usinara (5) Matsya (6) Kuru (7) Panchala (8) Kasi (9) Kosala and (10) Videha. They appear also to be appelations of the people living in them. Gandhara covers the region around Taxila (Takshasila) and Peshawar-Charsadda (Pushkalavati) in Pakistan. Recent excavations have brought the twin cities of Peshawar-Charsadda within the orbit of the Gandhara grave culture, imparting to them a hoarier antiquity than people were hitherto prepared to concede. This, incidentally, is supportive of the literary evidence, otherwise often held as unreliable.

The emergence of the 16 *Mahajanapadas* around 650 B.C. has already been mentioned earlier. Eight more *Mahajanapadas* occur in a later Jaina *sutra*, called the *Bhagavati Sutra*. The areas of the kingdoms and republican confederations are somewhat defined and their capital cities identified. The trend towards the urbanization of these areas is later than in the case of the earlier Painted

Grey Ware sites, and would only indicate later colonisation. This evidence accords well with the evidence of the easternmost of the earlier group of ten states, namely, Kasi or Rajghat for obvious reasons.

A reference must be made at this stage to the penetration of the peninsular part of India towards the middle of the first millennium B.C. These parts comprise the countries of *Vidarbha*, *Kalinga*, *Assaka* or *Asmaka*, *Bhojas*, *Dandaka*, *Andhras*, *Savaras*, *Pulindas* and *Mutibas*. The territories thus covered were in *Dakshinatya* (according to the *Baudhayana Sutra*) i.e. in the southern part of India.

This was the situation, and yet we find that the Maurya armies overran them in the third century B.C. but they could not make any headway against the obviously better organised *Colas*, *Pandyas*, *Satyaputras* and the *Keralaputras* who seem to have organised themselves into strong states and succeeded in maintaining their freedom against the imperial might. The Satyaputras are generally identified with the Andhras. In regard to the Andhras we are on firmer ground. A couple of centuries later, in the first century B.C., the Andhras (also known as Satavahana) set up an extensive and long-lasting kingdom in northern Deccan.

The comparatively slower development of states and cities in the south in the middle of the first millennium B.C. may, by inference, be attributed to the inability of the small tribal groups that dwelt in the area and were iron-using megalithians to sink their sectarian and *inter se* racial differences, as indicated apparently by the explicit differences in the morphology of their megalithic burials, as well as their cranial ratios and weld themselves into larger and viable units for territorial administration in spite of possessing superior and versatile equipments of iron and knowledge of the metallurgies of gold, silver, copper, and bronze and several other crafts and industries, including distinctive ceramics. It would, therefore, be essential to make more extensive studies of their burial practices and ways of life to be able to establish their exact tribal identities through ethno-archaeology and anthropology covering the present-day tribal groups such as the Chenchus, Lambadis, Banjaras, and Todas etc. and trace the reasons for their comparatively retrograde position in isolation.

A. Ghosh examined the ten characteristics of urban life laid down by V. Gordon Childe. He also examined the views of Arnold Toynbee on what constitutes a city.

It is quite apparent that regardless of the universal validity or otherwise of the criteria set forth by these scholars, not all conditions are to be met with in the Indian cities. But the basal requirement of the surplus in food to support those engaged in non-food-producing industries, such as administrators, artist-craftsmen, or for importation of raw materials is easily understood and conceded. Reference has already been made to the emergence of this phenomenon in northern India. The growth of the surplus may not have been caused by a demand for it but may have been the result of the possibility of larger areas being brought under cultivation through easier clearance of jungles and improved method of agriculture. The ideas of defensive ramparts, writing, sciences, and arts, are not felt to be as essential preconditions for the growth of cities. The Harappan defences appear more to have served as baffle walls against floods than as defence against enemies. All these may be features of subsequent development. The idea of a ruling class or individual rulers with checks and balances is as old as the *Rigveda*, with the *Rajan* or King, the *Sbaha* and *Samiti* (Inner Council and Assembly, respectively), when urban life was practically unknown but may have promoted the development of cities. Monumental public buildings like the Great Bath at Mohenjo-daro, the Granaries and workers' platforms at Harappa, the dockyard at Lothal are indeed early examples of public buildings, though temples did not emerge before the Mauryan period, except in the form of Buddhist *stupas*. But other public buildings would indeed be essential for practical utility and use of the administrator. They remain to be identified and isolated so far. Though defensive city walls did come into being in the Harappan civilization to protect the dwellers from raiders and to save the cities from the devastation of floods, the evidence of defences is not as expensive in the subsequent centuries for some inexplicable reasons until the middle of the first millennium B.C. or a little earlier. It may be observed that the so-called Harappan granaries were for some inexplicable reasons outside the defences, remaining as much vulnerable to floods as to extraneous enemies. Though artistic activities of one kind or other have been throughout in existence in the form of the ubiquitous terracottas of human and animal figurines and, rarely, bronzes (Mohenjo-daro and Daimabad), and sculptures in stone. Sculptures remained unknown after the decline of Harappa and the beginning of the Mauryan period.

Nevertheless Ghosh has stated that India had her 'second urbanism', borrowing nothing from the Indus civilization, in the middle of the first millennium B.C. after which urbanism has a continuous history in the country. It has been aptly demonstrated earlier that the rudiments of urbanism, if also formal urbanism, with or without the criterion of defensive city walls, gates and towers, did come into being in the period when the Painted Grey Ware was the dominant ceramic. Mate's theory stated below discounts the value of early ramparts as military defences. Mate has analysed the remains of early historical (6th century B.C.-2nd century A.D.) mud ramparts in the Ganga plains and at Ujjain and has concluded that the absence of any signs of parapet walls, except at Ahichchhatra, renders them all as baffle walls against floods with moats often serving as diversionary channels. Iron was vicariously but both directly and indirectly responsible for this culmination of material life in the absence of, or owing to the weakness of, other metallic objects as "working tools". This was primarily because of its basic superiority over copper in all its forms of wrought iron, mild steel or steel, as the case may be ; the greater abundance of iron ores in comparison to copper, not to speak of the scarcity of tin needed to harden it, was another contributory factor. The role of iron in the economic, social and political life of even the earliest stages of the Iron Age, barring local differences, especially in the south, are thus clear to see.

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APPENDIX IV

ON SYADVADA

A. *ANEKANTAVADA : THE PRINCIPAL JAINA CONTRIBUTION TO LOGIC*

SUKHLALJI SANGHVI

The first and the foremost of the contributions—one that is the key to the rest—made by the Jaina savants to Indian Logic (*pramana-sastra*) is the systematic exposition (*sastriya-nirupana*) of *Anekantavada* or the Doctrine of Non-Absolutism and (its corollary) *Nayavada* or the Doctrine of Partial Truths.

There are two mutually distinct, fundamental standpoints (*drsti*) for looking at the universe—one is that which tends towards generalization (*samanya-gamini*), the other that which tends towards particularization (*visesa-gamini*). The former starts with the observation of the similarities (*samanata*), but it is gradually inclined to emphasize non-distinction (*abheda*) and finally views the universe as rooted in something one and single ; hence it arrives at the conclusion that whatever is an object of awareness (*pratiti*) is, really speaking, some one single element (*tattva*). Thus passing beyond the initial stage (*prathamika bhumika*) of viewing similarities the standpoint in question culminates in viewing essential identity (*tattvika ekata*); whatever element is here asserted to be the sole object of awareness is also declared to be the sole reality (*sat*). Owing to its excessive preoccupation with the one ultimate real, this standpoint either fals to take note of diversities or it takes note of them but dismisses them as empirical (*vyavaharika*) or non-ultimate (*aparamarthika*) because according to it unreal (*avastavika*). This applies to all diversity we are aware of, be it diversity in respect of time (*kalakrta* : as, for example, that between the antecedent seed and the subsequent sprout), or diversity in respect of space (*desakrta* : as, for example, that between the simultaneously existing *prakrtika*, i.e. physical, modifications like jars, cloths, etc.), or innate diversity irrespective of space and time (*desa-kala-nirapeksa sahajika* : as, for example, that between *prakrti*, i.e. the root physical element, and *purusa*, i.e. the root conscious element, or that between one *purusa* and another).

As against this, the second standpoint sees dissimilarity (*asamanata*) everywhere, and gradually searching for the root of this dissimilarity it finally reaches that stage of analysis (*vislesana-bhumika*) were even similarity (*samanata*), nothing to say of identity (*ekata*), appears to be something artificial (*krtrima*, unreal); hence it arrives at the conclusion that the universe is but a conglomeration (*punja*) of several discrete existents (*bheda*) utterly dissimilar from one another. According to it, there really exists no single element (at the root of diversities), nor does there obtain any real similarity (between one existent and another). This applies to single elements like *prakrti* which (allegedly) pervade all space and persist for all time, as also to single elements like atoms which (allegedly) are mutually different substances (occupying different points in space) but ones that persist for all time.

The above-stated two standpoints are fundamentally different from one another, for one of them is based exclusively on synthesis, the other exclusively on analysis. These two fundamental lines of thought (*vicara-sarani*) and the derivative lines of thought developing out of the two give rise to a number of mutually conflicting views on a number of topics. We thus see that the first standpoint with its tendency to generalization led to the formulation of the doctrine of 'one, non-dual Brahman (Brahmadvaita)—the sole real element—occupying all space and time (*samagra-desa-kala-vyapin*) and free from the limitations of space and time (*desa-kala-vinirmukta*)'. This doctrine, on the one hand, dubbed as unreal (*mithya*) all diversity and all organs of knowledge taking note of this diversity, while, on the other hand, it asserted that the real-element (*sat-tattva*) lies beyond the reach (*pravrtti*) of speech (*vani*) and logic (*tarka*) and is amenable to bare experience (i.e. experience untrammelled by speech and logic) (*matra anubhava-gamya*). Likewise, the second standpoint with its tendency to particularization led to the formulation of the doctrine of 'an infinite number of discrete existents, each different from the rest not only as to its spatiotemporal location but as to its very nature'. This doctrine too, on the one hand, dubbed all non-distinction (*abheda*) as unreal while, on the other hand, asserted that the ultimate discrete existents lie beyond the reach of speech and logic and are amenable to bare experience. Thus both the doctrines in question did ultimately arrive at one common conclusion, viz. that whatever is revealed by speech and logic is a nullity (*sunya*) while the ultimate reality is amenable to bare experience ; but their ultimate objectives (*laksya*) being utterly different the two came in headlong clash and emerged as rivals to each other.

There also came into existence a number of lines of thought that either sprang from or were related to these two fundamental lines. Some of them accepted non-distinction (*abheda*) but only in respect of space and time or in respect of mere time, that is, not in respect of essential or substantial nature. Thus one line of thought did posit multiplicity of substances but regarded them all as eternal from the point of view of time and ubiquitous from that of space ; the Sankya doctrine of *prakrti* and *purusa* (*prakrti-purusavada*) is an instance in point. Another line of thought came to attribute a comparatively greater extension to the sphere of diversity. Thus even while positing entities that are eternal and ubiquitous this line also posited a multiplicity of entities that are physical by nature (and hence occupying different points in space); the (Nyaya-Vaisesika) doctrine of atomic-as-well-as-ubiquitous-substances (*paramanu-vibhu-dravya-vada*) is an instance in point.

It was but natural that the standpoint of exclusive non-dualism (*advaita-matra*) and exclusive monism (*san-matra*)—a standpoint tolerant of no diversity in any respect—should lead to the formulation of numerous doctrines based on the acceptance of non-distinction (*abheda-mulaka-vada*). And this is what actually happened. Thus the standpoint gave rise to the doctrine of *satkaryavada*, according to which there is a non-distinction between a cause and its effect ; similarly, it gave rise to the doctrine of non-distinction between an attribute (*dharma*) and that which possesses this attribute (*dharmin*), a quality (*guna*), and that which possesses this quality (*gunin*), a substratum (*adhara*) and that which is supported by this substratum (*adheya*), and so on and so forth. On the other hand, the standpoint of exclusive pluralism (*dvaita-matra*)[1] and exclusive distinction (*bheda-matra*) led to the formulation of numerous doctrines based on the acceptance of distinction (*bheda-mulaka-vada*). Thus it gave rise to the doctrine of *asatkaryavada*, according to which there is absolute distinction between a cause and its effect ; similarly, it gave rise to the doctrine of absolute distinction between an attribute and that which possesses this attribute, a quality and that which possesses this quality, a substratum and that which is supported by this substratum, and so on and so forth. Thus we find that in the field of Indian philosophical speculation a number of mutually antagonistic views (*mata*) and systems (*darsana*) arose out of the fundamental standpoints of generality (along with its derivative standpoints) and the fundamental standpoint of particularity (along with its derivative standpoints). These views and systems, without caring for the element of truth that might underlie a rival view or system, made it their prime concern to attack one another.

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[1] Here '*dvi*' stands not for 'two' but for 'more than one'. Tr.

The doctrine of pre-existence (*sad-vada*)—be it non-dualistic (as in Vedanta) or dualistic (as in Sankhya)—cannot achieve its basic aim without accepting *satkaryavada*, according to which there is a non-distinction between a cause and its effect ; on the other hand, the doctrine of pre-nonexistence (*asad-vada*)—be it applied to momentary entities as in Buddhism or to static and eternal entities as in Vaisesika etc.—cannot achieve its basic aim without accepting *asatkaryavada* (according to which there is absolute distinction between a cause and its effect).[2] Hence *satkaryavada* came in clash with *asatkaryavada*. Similarly, the theory of permanence-without-change (i.e. eternity : *kutasthata, kalika nityata*) and all-pervadedness (i.e. ubiquity : *vibhuta, daisika vyapakata*)—a theory resulting from the doctrine of pre-existence, dualistic or non-dualistic—came in clash with the theory of spatially as well temporally impartite, ultimate elements (*desa-kala-krta-niramsa-amsa-vada*), that is, with the theory of impartite moments (*niramsa-ksana-vada*)—a theory resulting from the doctrine rival to the doctrine of pre-existence. Now those who regard the entire universe as some single (*eka*), continuous (*akhanda*) element (*tattva*) also those who regard it as a mere conglomeration (*punja*) of impartite (*niramsa*), ultimate elements (*amsa*) could achieve their respective aims only by maintaining that the ultimate real posited in their respective systems is incapable of definition and description through words (*anirvacaniya*, *anabhilapya*, *sabdagocara*); for if the real is capable of definition through words it can be neither some single, continuous element nor a multiplicity of impartite, ultimate elements, and this, in turn, is because definition puts an end as it were to continuity (in one single form) as well as to impartibility. Thus the theory of indefinability (*anirvacaniyatvavada*) arose as a natural corollary to the doctrine of one continuous real as also to the doctrine of impartite distinct reals. But this theory was taken exception to by the Vaisesika logicians and others who averred that to describe and define every real entity (*vastumatra*) is not only a possibility but an accomplished fact. Thus arose the theory of definability (*nirvacaniyatvavada*) that came in clash with the rival theory of indefinability (*anirvacaniyatvavada*).

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[2] By *sadvada* or the doctrine of pre-existence we mean the doctrine that an entity exists always (or it is not a real entity): by *asadvada* or the doctrine of pre-nonexistence we mean the doctrine that a real entity—at least in case it happens to be a produced entity—exists only for an interval of time (possible for one moment).—Tr.

In a like manner, some people upheld the view that is is dangerous to arrive at a final conclusion by means of an organ of knowledge—of whatever sort—unaided by reason (*hetu*) or logic (*tarka*); others, on the contrary, maintained that logic possesses no independent force, and that the Scripture, inasmuch as it does possess an independent force, is the seniormost (*murdhanya*) of all organs of knowledge. Hence the clash between these two viewpoints. Again, the fatalist (*daiva-vadin*) would say that everything depends on fate (*daiva*) and the human endeavour (*purusartha*) is independently of no avail, the protagonist of human endeavour would maintain just the opposite view that man's endeavour is independently capable of delivering the goods (*karyakara*). Thus each thought that the other was in the wrong. Likewise, one-sided view (*naya*) emphasized the importances of the denoted entity (*artha*) at the cost of denoting word (*sabda*), the other that of the denoting word at the cost of the denoted entity; and the two argued against each other. Similarly, some thought that absence (*abhava*) is an independent entity alongside of the positive one (*bhava*) while others that it is but of the nature of the positive entity, and thus developed the attitude of hostility between them. Furthermore, some thought that an organ of knowledge (*pramana*) and the resulting piece of knowledge (*pramiti*) are utterly distinct (*atyanta bhinna*) from the knower (*pramata*) concerned, while others that they are non-distinct (*abhinna*) from the later. Lastly, some emphasized that the sole means for attaining the desired (ultimate) result is action performed in conformity with the Varna-Asrama rules, others insisted that knowledge alone will lead to (absolute) bliss, while still others maintained that devotion (*bhakti*) is the only instrument for realizing the *summum bonum*. Thus on a number of major or minor problems pertaining to metaphysics and ethics several such views had been in vogue as were extremist (*ekanta*) and wholly antagonistic to one another.

On noticing this debating sport (*vada-lila*) indulged in by the advocates of the extremist doctrines (*ekanta*), the following question occurred to the teachers who were inheritors of the non-absolutist (*anekanta* ; non-extremist) standpoint : why are these doctrines—each claiming to be true—so much in conflict with one another ? Is it that *none* of them contains any element of truth, or that *each* of them contains *some* element of truth, or that *some* of them contains *some* element of truth, or that *each* of them contains the *whole* truth ? The cognition over this question furnished these teachers with a clue that would put an end to all conflict and reveal the whole truth ; the clue was the non-absolutist standpoint that forms the ground (*bhumika*) of the doctrine called *Anekantavada*. This standpoint enabled our teachers to see that all particular theory based on logic (*sayuktika*) is true to a certain extent and from a certain point of view. However, when a particular theory, refusing to take into account the line of thought and the sphere of application (*sima*) of the rival theory, imagines that everything lies within the sphere covered by its own standpoint it turns blind to the truth contained in this rival theory. And the same thing happens with this rival theory (that is to say, it too imagines that everything lies within the sphere covered by its own standpoint). Under these circumstances, justice demands that a theory be tested keeping in view its specific line of thought and its specific sphere of application, and in case it passes the test it should be treated as an aspect (*bhaga*) of truth ; subsequently, a sort of necklace ought to be prepared with the various aspects of truth—uncontradictory of one another—acting as diamonds (*satyamsarupa-mani*) and the idea of whole truth acting as the running thread (*purna-satya-*

rupa-vicara-sutra). These considerations impelled the Jaina teachers to synthesize (*samanvaya*; harmonize), on the basis of their non-absolutist standpoint, all the theories that were then prevalent. And this is how their thought ran. When certain pure (*suddha*) and selfless (*nihsvartha*) minds are cognizant of similarity culminating in identity and when certain other minds (no less pure and selfless) are cognizant of (diversity culminating in) impartite ultimate elements, how can we say that one of these cognitions (*pratiti*) is valid and the other not? If one of these cognitions is somehow treated as invalid the same logic will compel you to treat the other as equally so. Moreover, granting that one of these cognitions is valid and the other not, you will have to offer a logical explanation (*upapatti*) of what in our everyday dealings (*sarvajanika vyavahara*) is taken as forming the object of the cognition—of identity or of diversity as the case may be—dismissed as invalid. Certainly, a mere assertion to the effect that one of these cognitions is valid and the other not will not mean a logical explanation of our everyday dealings, empirical (*laukika*) or sastric (*sastriya*). Nor can you leave these dealings unexplained. So the monistic Brahmavadin's explanation of the phenomena in question will lie in treating as a product of ignorance (*avidya-mulaka*) all diversity and our cognition thereof, while the momentarist's explanation will lie in treating as a product of ignorance all similarity or identity and our cognition thereof.

These thoughts led advocates of *Anekantavada* to realize, in the light of their non-absolutist standpoint, that all cognition—be it cognition of identity or that of diversity—is after all valid (*vastavika*). A cognition is valid in relation to its own object, but when it arrogates to itself the right to demonstrate the unreality of the object of another cognition seemingly contradictory of itself it turns invalid. The cognition of identity and the cognition of diversity seem to be contradictory of each other simply because one of them is mistaken to be the whole truth (*purna-pramana*). As a matter of fact, both these cognitions are valid so far as they go, but neither is the whole truth though each is a part (*amsa*) thereof. The total nature of reality ought to be such that these seemingly contradictory cognitions might reveal it in their respective ways but without contradicting one another and might both be treated as valid insofar as both go to reveal the total nature of reality. This synthesis, that is, the idea that the two cognitions in question have two different spheres to operate in (*vyavastha-garbhita vicara*), enabled the advocates of *Anekantavada* to see that there is no real conflict between monism (*sad-advaita*) and pluralism (*sad-dvaita*), for the total nature of reality comprises identity as well as diversity, generality as well as particularity. For example, when we think of that huge mass of water and disregard its place, time, colour, taste, dimension, etc. it appears before us in the form of one single entity called ocean. On the other hand, when we take into account the place, time, etc. of this very mass of water we begin to see a number of oceans—small and big—instead of one gradually, we do not even perceive even a sigle drop of water but certain impartite elements like colour, taste, etc., and, eventually, they too appear as nought (*sunya*). Cognition of the mass of water as one single ocean is valid, and so also is its cognition as (a conglomeration of) ultimate elements. The cognition of one (single ocean) is valid because it views diversities (*bheda*) not as standing out separately from one another but as together exhibiting one common form ; likewise, the cognition of diversities-as-to-spatio-temporal-location-etc.—diversities which totally demarcate (*vyavrtta*) the elements concerned from one another—is valid because these diversities are actually there. Inasmuch as the mass of water is in fact one as well as a multiplicity, our cognition of it as one single ocean is as much valid as our cognition of it as a multiplicity of ultimate elements ; but since neither of these cognitions grasps the total nature of reality, neither of them is the whole truth, though the two together do constitute the whole truth. Analogously, when we view the entire universe as one single real, in other words, when we take note of "existence" (*satta*) which is common (*anugamaka*) to all diverse existents, we say that all reality is one and single ; for while taking note of the all-comprehensive (*sarvavyapaka*) "existence" we are aware of no diversities demarcated from one another, and that, in turn, is because all diversities are here revealed as exhibiting one collective and common form, viz. "existence". Hence the epithet "Monism" or "Doctrine of Non-dual Reality" (*sad-advaita*) attributed to this viewpoint. When we confine our attention to what is common to all existents and call the universe '(one single) real' (*sat*) the denotation of the word "real" becomes so wide as to exclude nothing (i.e. no existing entity) whatsoever. However, when we view the universe as possessed of the mutually demarcated diversities of qualities and attributes, it no more appears in the form of one real (*sat*) but becomes a multiplicity of reals. In that case, the denotation of the word "real" undergoes corresponding limitation (for now we do not at all speak of real in general but only of this or that type of real). Thus we say that some reals are physical while some conscious ; going further in the direction of noticing diversities we say that there are a number of physical reals and a number of conscious reals. Thus when we view the one all-comprehensive real as divided into mutually demarcated diversities, it appears before us as a multiplicity of reals. This is the viewpoint of "Pluralism" or the "Doctrine of Diverse Reals" (*sad-dvaita*). Thus the monistic and pluralistic viewpoints are valid in their respective spheres, but they will go to constitute the whole truth only when they are combined together as complementary to each other (*sapeksa-bhavena*). This then is the synthesis, arrived at from the non-absolutist standpoint, of monism and pluralism which are generally supposed to be mutually antagonistic.

The same idea can be elucidated with the help of the illustration of trees and the forest. When the several, mutually different, particular trees are viewed not in the form of this or that particular trees but in a collective, general form designated "forest" the particular features of these different trees do not cease to exist but they are so much absorbed (*lina*) in the general feature—observed for the time being—of these trees as to appear to be non-existent. In this case we see the forest and it alone and our outlook may be characterised as monistic. Again, sometimes we take note of these trees one by one, that is, in the form of particular entities. Here we see the particular entities and them alone, and the general feature of these entities is so much absorbed in their particular features—observed for the time being—as to appear to be non-existent. Now an analysis of these two cognitions (*anubhava*) will suggest that neither can be regarded as solely true, i.e. true at the cost of the other. Both are true within their respective spheres but neither represents the whole truth ; for the whole truth lies in a proper synthesis of these two cognitions. Only such a synthesis can do justice to the two cognitions, viz. cognition of the forest in general and cognition of each, single, particular tree, both of which are uncontradicted (*abadhita*). The same holds good of the monistic and pluralistic world-views (that is to say, they too represent the whole truth only when properly synthesized).

The above was an account of the monism *versus* pluralism controversy in regard to features that might be spatial (*daisika*), temporal (*kalika*), or non-spatiotemporal (*desakalatita*): there is a special controversy between the doctrine of temporal generality (*kalika samanya*) or eternalism (*nityatvavada*) and the doctrine of temporal particularity (*kalika visesa*) or momentarism (*ksanikatvavada*). These two doctrines too seem to be mutually antagonistic, but the non-absolutist standpoint suggests that there is no real conflict between the two. Thus when an element (*tattva*) is viewed as being continuous (*akhanda*) throughout the three periods of time, that is, as beginningless and endless, it is certainly eternal (*nitya*), for in that case it is of the form of a continuous flow (*akhanda pravaha*) that has no beginning and no end. But when the same element—undergoing that continuous flow—is viewed as divided in terms of relatively large or small temporal units (*kala-bheda*) it appears as having assumed a limited (*simita*) form which lasts for this or that interval and which therefore has a beginning as well as an end. And in case the interval in question is too brief to admit of further dissection by means of intellectual weapons (*buddhi-sastra*), that portion of the element-in-continuous-flow which occupies this interval is called momentary (*ksanika*) because smallest possible. The words eternal and momentary are considered to be each other's antonyms (*viruddharthaka*); for the connotation of one includes lack of a beginning and of an end (*anadi-anantata*), while that of the other possession of a beginning and of an end (*sadi-santata*). However, viewing from the non-absolutist standpoint, we can see that the same element which is called 'eternal' insofar as it is of the form of a continuous flow may also be called 'momentary' insofar as it undergoes a change (*parivartana*) or a new modification (*paryaya*) every moment. The basis of one viewpoint is the observation of beginninglessness and endlessness, that of the other the observation of beginnings and ends. But the total nature of a real entity comprises the lack of a beginning and of an end as also the possession of a beginning and of an end. Hence the viewpoints in question, though true within their respective spheres, will yield the whole truth only when properly synthesized.

This synthesis, too, can be elucidated with the help of an illustration. The total life-activity of a tree—right from the beginning uptil the time of fructification—completes its course only by flowing through the successive stages represented by the seed, the root, sprout, the trunk, the branches and twigs, the leaves, the flowers, the fruits, etc. So when we view an entity as a 'tree' we have in mind the total life-activity continuously flowing through these various stages. On the other hand, when we grasp, one by one, the successively emerging elements—like root, sprout, trunk, etc. —of this life-activity we have in mind but these various elements, each possessing a limited duration. Thus our mind takes note of the life-activity in question sometimes in one continuous form and sometimes in a discontinuous form, that is, element by element. On closer investigation it becomes evident that neither is the continuous life-activity either the whole truth or but a product of imagination, nor are the discontinuous elements either the whole truth or but a product of imagination.[3] Even granting that the continuous life-activity absorbs within itself the totality of discontinuous elements or that the discontinuous elements absorb within themselves the total continuous life-activity, the fact reremains that a real entity, viewed in its total nature, is continuous as well as discontinuous, and that therefore it is grasped only when both these aspects of its nature are (separately) taken note of. These two aspects are both real so far as each of them goes, but they become totally real only when synthesized. To view the tree as a beginningless and endless flow in time is to indicate it as an eternal entity, to view the tree as made up of (the successively emerging) elements is to indicate it as a transient or momentary entity. The transient constituent elements (*ghataka*) are inconceivable without a substratum in the form of an eternal flow, and this eternal flow is inconceivable without those transient constituent elements. Thus the view that eternity is real while transience unreal and the view that transience is real while eternity unreal give rise to the eternalism *versus* momentarism controversy which, however, is eliminable from the non-absoluist standpoint.

[3] That the continuous life-activity is the whole truth and discontinuous elements but a product of imagination is the eternalist's position, that the discontinuous elements are the whole truth and the continuous life-activity but a product of imagination is the momentarist's position.—Tr.

The non-absolutist standpoint also eliminates the controversy between the doctrine of definability and the doctrine of indefinability. For according to it, only that aspect of an entity's nature is amenable to description (*pratipadya*) which can be made an object of convention (i.e. conventional attribution of words : *sanketa*). Now even though a convention is established by *buddhi* (i.e. intellect) which is subtle in the extreme (*suksmatama*), the object of this convention must be some gross (*sthula*) aspect of the nature of an entity ; for there are innumerable (subtle) aspects of an entity's nature which are inherently incapable of description through words. It is in this sense that the one continuous real (*akhanda sat*) as well as the impartite moment (i.e. ultimate element) (*niramsa ksana*) are indefinable, while the gross entities of medium duration (and extension) are capable of definition. Thus the doctrine of definability and the doctrine of indefinability—applied to the entire universe or to an element thereof—are true within their respective spheres and wholly true when taken together.

Nor is it self-contradictory to view a thing as a positive entity and also as an 'absence'. For a thing is never cognized either solely through its positive traits (*matra-vidhimukhena*) or solely through its negative traits (*matra nisedhamukhena*). E.g. the milk is cognized as milk and also as not-curd, i.e. something different from curd. This means that the milk is of a positive-cum-negative nature (*bhava-abhava-ubhaya-rupa*). Thus it is not self-contradictory to maintain that a thing is a positive entity and also an 'absence', for two different cognitions take note of these two aspects of the thing's nature. Similarly, the non-absolutist standpoint resolves the controversy as to whether the members of other similar pairs (*dvandva*)—e.g. 'attribute and the possessor of the attribute (*dharma-dharmin*), 'quality and the possessor of the quality' (*guna-gunin*), 'cause and effect' (*karya-karana*), 'substratum and superstratum' (*adhara-adheya*)—are identical with one another or different from one another.

When the authoritativeness (*aptatva*) and the validity of source (*mula-pramanya*) (of a verbal testimony) are in doubt, it is always well to decide an issue after examining (*pariksa*) the matter ratiocinatively (*hetuvada-dvara*); but in case the authoritativeness (of the testimony in question) is beyond doubt, resort to ratiocination only leads to an infinite regress and is to be discarded. In this latter case reliance on the Scripture (*agamavada*) has to be our sole guide. Thus both ratiocination and reliance-on-the-Scripture have a scope, but they apply to different subject-matters (*visaya*) or to different sorts of exposition (*pratipadana*) of the same subject-matter. In one word, there is no conflict between the two. The same is the case with the doctrine of Fate (*daivavada*) and the doctrine of Human Endeavour (*paurusa-vada*), for there is no conflict between them either. In those cases where endeavour based on rational calculation (*buddhi-purvaka paurusa*) is an impossibility, problems can be solved only by the doctrine of Fate, where endeavour of this type is possible the doctrine of Human Endeavour is in place. Thus the doctrine of Fate and the doctrine of Endevour can be reconciled harmoniously, provided one keeps in view that the two cover different aspects of life.

The non-absolutist standpoint easily succeeds also in eliminating the opposition between the 'doctrine of absolute presence of the effect in the cause' and the 'doctrine of absolute absence of the effect in the cause'. For according to it, the effect (*karya*) is present as well as absent in the material cause (*upadana*). E.g. even before it is actually turned into a bangle, a piece of gold has the capacity (*sakti*), to turn into a bangle ; thus viewed in the form of a 'capacity' (*sakti*), that is, in the form of something non-distinct from the cause, the effect can be said to be present even before it is actually produced. However, even though present in the form of a capacity, this effect is not there to be seen (*upalabdha*), because the absence of necessary accessories (*utpadana-samagri*) has prevented it from emerging into being, i.e. from being produced ; in this sense the effect is absent (before it is actually produced). Again, after the bangle has disappeared and the material concerned turned into an earring, the bangle is doubtless not there to be seen, but since even the gold turned-into-an-earring possesses the capacity to turn into a bangle, the actually absent bangle can be said to be potentially present in this gold.

The Buddhist's 'doctrine of mere conglomeration of atoms' (*kevala-paramanupunja-vada*) and the Naiyayika's 'doctrine of an altogether novel composition' (*apurva-avayavi-vada*) come in conflict with one another. But the non-absolutist standpoint with its acceptance of *skandha*, which is neither a mere conglomeration of atoms nor something so contradictory of experience (*badhita*) as a composite standing over and above its component-parts, properly resolves the conflict and works out a flawless synthesis of the two doctrines. Thus the non-absolutist standpoint has impartially synthesized, on so many questions, the current doctrines that were clashing with each other. And in the course of its doing so, the doctrine of Nayas (*nayavada*) and the doctrine at *Bhangas* (*bhangavada*) follow as a natural corollary ; for a proper formulation of non-absolutism requires as its preliminary an analysis of the different stands and view-points, a demarcation of their respective subject-matters, and a determination of their roles concerning one and the same subject-matter.

No one corner of a house makes the whole house, nor do the different corners of this house lie in one particular direction. The view (*avalokana*) had of the house from one of the two opposite directions—like south and north, or east and west—is certainly not full but nor it it false. It is the totality (*samuccaya*) of the views had of the house from different possible angles which may be called a full view of the house. Thus the view had of the house from one particular angle is a necessary part of the total view of the house. Analogously, the formulation of thoughts and views (*cintana-darsana*) concerning the nature of an entity or of the entire universe is accomplished from various stands (*apeksa*). And a stand is determined by a multiplicity of factors like the innate constitution (*sahaja racana*) of the mind, the impressions (*samskara*) received from outside, the nature of the object thought about, etc. Such stands—for thinking about the nature of things—are many in number. And since these stands form the basis or the starting point of the viewing process (*vicara* ; lit. thought-process) they are also called 'angles of vision' (*drstikona*) or 'points of view' (*drstibindu*). The harmonious totality (*sara-samuccaya*) of the thoughts and views concerning a thing formed from different stands—however contradictory of each other in appearance—is called the total view or the non-absolutist view of this thing. The view formed from a particular stand is a part of this total view, and though the different such views (i.e. the views formed from different particular stands) are (seemingly) contradictory of one another, they are really uncontradictory of one another inasmuch as they all find synthesis in the total view.

When a mind ignores and takes no account of diversities—qualitative (*guna-dharmakrta*) or essential (*svarupa-krta*) as well as numerical (*vyaktitva-krta*)—while confining its attention to mere continuity (*akhandata*) the universe appears to it as one and continuous. Understood from this standpoint of non-distinction (*abheda*), the word 'real' means something one and continuous (and nothing more), and this type of partially true understanding of things is technically called *sangraha-naya* (where *naya* stands for a partially true understanding of things). The view taken of the universe from the standpoint of diversities—qualitative as well as numerical—is technically called *vyavahara-naya*, for here special importance is assigned to the diversities on which is grounded our everyday experience (*loka-siddha vyavahara*). On this view, the word 'real' denotes not something one and continuous but things different and discontinuous. When this tendency to take note of diversities confines its attention to mere temporal diversities, and concludes that the present alone is real because it alone is capable of performing a function (*karyakara*), that is to say, when the past and the future are excluded from the denotation of the word 'real', there results a partially true understanding of things which is technically called *rjusutra-naya*. It is so called because it seeks to avoid the labyrinth (*cakravyuha*) of the past and the future while sliding along the straight line (*rju-rekha*) representing the present.

The above-stated three attitudes consider the nature of things without basing themselves on (the consideration of) words and their qualities and attributes. Hence the three resulting understandings are designated *artha-naya*. But there are also possible attitudes which consider the nature of things basing themselves on (the consideration of) words and their qualities and attributes. The understandings resulting from these attitudes are designated *sabda-naya*. Grammarians are the chief advocates of the various *sabda-nayas*, for it is on account of the divergent standpoints upheld by the grammarians that one *sabda-naya* differs from others.

Those grammarians who regard all words as impartite (*akhanda*) or etymologically underived (*avyutpanna*), certainly, do not base on etymology their distinction of the meaning of one word from that of another, but they too hold that words mean different things according as they possess different attributes (*dharma*) in the form of gender, person, tense, etc. This type of distinguishing the meaning of one word from that of another is called *sabda-naya* or *samprata-naya*. On the other hand, those grammarians who regard all words as etymologically derived (*vyutpanna*) posit distinction between the meanings of even such words as are generally admitted to be synonymous ; this view, according to which (for example) the synonyms like '*sakra*', '*indra*', etc. have different meanings, is called *samabhirudha-naya*. Lastly, there is a view according to which a word applies to a thing not in case this thing *sometimes* satisfies the etymology of the word in question, but only in case this thing is for the time being satisfying this etymology.[4] This view is called *evambhuta-naya*. Apart from these six logical *nayas* there is a seventh called *naigama-naya*. *Nigama* literally means local convention (*desa-rudhi*), and this seventh *naya* stands for the view which includes —in accordance with local conventions—all kinds of doctrines of distinction and the doctrines of non-distinction.[5] These are the seven chief (not all) *nayas*, and, really and generally speaking whatever understanding of things results from the adoption of one particular standpoint rather than any other is the *naya* corresponding to that standpoint.

The Jaina texts also speak of the two *nayas* called *dravyarthika-naya* and *paryayarthika-naya* ; however, these are not something over and above the abovementioned seven *nayas* but a mere broad classification (*samksipta vargikarana*) of and an introductory ground (*bhumika*) to these very seven *nayas*. *Dravyarthika-naya* is that line of thought which takes 'substance' (*dravya*) into account, that is, which takes into account what is general (*samanya*), common (*anvaya*), non-distinctive (*abheda*) or unitary (*ekatva*) about things. The *navas* called *naigama*, *samgraha* and *vyavahara* are comprised within *dravyarthika-naya*. Of these, *samgraha-naya*, inasmuch as it takes note of pure non-distinction, is the pure (*suddha*) or basic (*mula*) *dravyarthika-naya* : but even *vyavahara-naya* and *naigama-naya*, which no doubt take

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4. E.g. '*go*'—the Sanskrit word for cow—means 'that which moves'. Hence on this view, a cow cannot be called '*go*' when it is not actually in motion.—Tr.
5. More literally, *naigama-naya* may mean understanding based on the convention of the market-place. Really speaking, it is not a considered conviction concerning the nature of things but just an uncritical acceptance of whatever views are offered as and when occasion arises. There is also another interpretation of the word *naigama-naya*, but that is not relevant in the present context.—Tr.

note of certain distinctions, are invariably cognizant also of non-distinction of some type or other. Hence it is that these latter two *nayas* are also classed under *dravyarthika-naya*, but they are *dravyarthika-nayas* of an impure (*asuadha*) or mixed (*misrita*) type (and not of the pure and basic type as in *samgraha-naya*).

Paryayarthika-naya is the name for that line of thought which takes 'modes' (*paryaya*) into account, that is, which takes into account what is particular (*visesa*), exclusive (*vyavrtti*) or distinctive (*bheda*) about things. The remaining four *nayas*—i.e. *rjusutra* etc.—are comprised within *paryayarthika-naya*. Consideration of distinctions by a neglect of non-distinctions starts with *rjusutra-naya*, and hence the Texts call this *naya* the *prakrti* or root-basis (*mula*) of *paryayarthika-naya*. The remaining three *nayas*—i.e. *sabda-naya* (*samprata-naya*) etc.—are in a way the amplifications of this basic sort of *paryayarthika-naya*.

Similarly, the line of thought which attaches sole utility to knowledge will be called *jnana-naya* while that which attaches sole utility to action will be called *kriya-naya*. In short, the total —i.e. non-absolutistic—view of the universe is unlimited (*nihsima*) because the *nayas* that form the basis of this view are unlimited (in number).

The multifarious views concerning one and the same entity that result from the adoption of the various stands (*apeksa*), angles of vision (*drstikona*), and approaches (*manovrtti*) constitute the foundation of *Bhangavada* or the Doctrine of Manifold Judgment. When two views whose subject-matters are diametrically opposite of each other are sought to be synthesized, and with this end in view such (simple) judgments are formed as given expression to the positive as well as negative aspects of the (two) subject-matters in question, the result is a (complex) sevenfold judgment (*saptabhangi*). The Doctrine of Partial Truths (*nayavada*) is the basis of the Doctrine of Sevenfold Judgment (*saptabhangi*) and the later doctrine aims at an all-comprehensive (*vyapaka*) harmoniously synthesized—i.e. non-absolutistic—understanding of things. Just as inference-for-the-sake-of-others (*pararthanumana*)—i.e. inference expressed in the form of verbal propositions—is resorted to when one seeks to convey to others a piece of knowledge that he has come to acquire through some particular organ of knowledge, similarly, resort is taken to the simple judgments that go to constitute a complex sevenfold judgment when one seeks to convey to others how certain mutually contradictory trains are harmoniously synthesized in one single whole. Thus the Doctrine of Partial Truths (*nayavada*) and the Doctrine of Manifold Judgment (*bhangavada*) are natural corollaries to the non-absolutistic standpoint.

True, in the Vedicist philosophical systems like Nyaya-Vaisesika, Vedanta, etc. and so also in the philosophy of Buddhism, we often come accross a tendency (*drsti*) to view the same thing from different standpoints and thus synthesize its various aspects;[6] but the utmost insistence (*atyantika agraha*) that every aspect of *everything* must be viewed from every possible standpoint, and the unflinching faith that the consummation of all thought-process lies only in a synthesis of all possible standpoints, are to be found nowhere except in the Jaina system of philosophy. It was as a result of this insistence (and this faith) that the Jainas gave birth to those independent (*svatantra*), systematic disciplines (*vyavasthita sastra*) called 'Doctrine of Non-Absolutism' (*anekantavada*), 'Doctrine of Partial Truths' (*nayavada*), and 'Doctrine of Sevenfold Judgment' (*saptabhangi*), disciplines which became a part and parcel of their treatment of Logic (*pramana-sastra*) and on which no other school produced even a single or even a minor text. Though an advocate of *Vibhajyavada* (Doctrine of the Avoidance of Extremes) and *Madhyamamarga* (Middle Path), the Buddhist system remained blind to the element of permanence exhibited by a real entity, and hence declared everything to be but momentary. Similarly, though actually employing the word "*anekanta*" to characterize their own standpoint,[7] the Naiyayikas could not help harping on the thesis that atoms, souls, etc. are absolutely unchanging (*sarvatha aparinamin*). Again, the Vedantists, even while taking recourse to the various standpoints called 'empirical' (*vyavaharika*), 'ultimate' (*paramarthika*), etc., could not help insisting that all standpoints except the standpoint of *Brahman* (*Brahma-drsti*) are of an inferior—or even utterly false—sort. The only reason for this anomaly seems to be that these systems did not imbibe the spirit of non-absolutism to the same extent as did the Jaina. Thus the Jaina synthesizes all the stand-

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6. See *Sankhya-pravacana-bhasya*, p. 2 ; *Siddhanta-bindu*, p. 119 seq. ; *Vedantasara*, p. 25 ; *Trakasamgrahadipika*, p. 175 ; *Mahavagga*, 6.31.
7. *Nyaya-bhasya*, 2.1.18.

points and, at the same time, grants that all these standpoint are equally competent and true so far as their respective spheres are concerned. Since the Jaina's non-absolutistic standpoint and the systematic treatises composed by him on the subject, concern themselves exclusively with the time-honoured philosophical controversies like identity versus difference, generality versus particularity, eternity versus transience, etc., it might appear, at first sight, that all this is repetitive, hackneyed, and something lacking in originality ; but the spirit of accepting (nothing save) the total (*akhanda*), living (*sajiva*), and all-sided (*sarvamsa*) truth—a spirit reflected in the standpoint and the treatises in question—which is so characteristic of the Jaina and which found entrance in Logic through him, is capable of successful employment in all the fields of life, and may on that account be regarded, not unduly, as a contribution made to (Indian) Logic by the Jaina savants.

APPENDIX IV

B. *THE FOUNDATIONS OF STATISTICS*

(A Study in Jaina Logic)

P. C. MAHALANOBIS

Introduction

0.1. I am particularly grateful to Professor F. Gonseth and Professor A. Linder, the organizers of the Zurich Symposium which was held in the Swiss Federal Institute of Technology in Zurich in April 1953, for having invited me to open the discussion on the foundations of statistics. In my opening observations I had referred to certain ideas in the Indian-Jaina theory of *syadvada*[1] which aroused much interest ; and I was requested to give a fuller account of Jaina views at the time of preparing the text of my communication. I am doing this in Part I of the present paper.

0.2. There was also a brisk discussion on some of the views which I had placed before the symposium. It was suggested that I should take into consideration these comments and amplify to some extent my own arguments in writing out my communication. I intend to give my own views in Part 2 of the present paper broadly on the basis of the observations made by me at the Zurich symposium with, however, certain additions and amplifications to deal with some comments made by the other speakers.

0.3. I wish to offer my since thanks to Professor Linder for looking through the manuscript of the paper and for making valuable comments and suggestions.

Part I. The Indian-Jaina dailectic of *Syadvada* in relation to probability.

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[1] Usually described as [The dialectic of the sevenfold categories of knowledge]. In the present paper I have given references to books in the English language and not to original Sanakrit texts because these are not likely to be readily available in Europe. The English books (to which I referred) give very full bibliographical references to original texts.

1. *Brief history of* syadvada

1.1. There are certain ideas in Indian-Jaina logic called *syadvada* which seem to have close relevance to the concepts of probability, and which can, therefore, supply a convenient background to my own observations on the foundations of statistics. It is always difficult to be sure about the exact meaning of logical and philosophical phrases which were current 1500 or 2500 years ago : and it is not claimed (and I also agree that it would not be correct to claim) that the concept of probability in its present form was recognized in *syadvada* but the phrases used in *syadvada* seem to have a special significance in connexion with the logic of statistical inference.

1.2. I shall first give a brief historical account of *syadvada*. Jaina religion and philosophy came into prominence from the time of its great leader Mahavira (599-527 B.C.) who was a contemporary of Buddha, the founder, of the Buddhist religion The earliest reference to *syadvada* occurs in the writings of Bhadrabahu who is believed to have given the following explanation of *syadvada* : *syat*=[may be], and *vada*=[assertion], or the assertion of possibilities.[2]

[The *syadvada* is set forth as follows : (1) May be, it is, (2) may be, it is not ; (3) may be, it is and it is not ; (4) may be, it is indescribable ; (5) may be, it is and yet it is indescribable ; (6) may be, it is not and it is also indescribable ; (7) may be, it is and it is not and it is also indescribable.][3]

1.3. There were two authors of the name Bhardrabahu, the senior belonging to the period 433-357 B.C., and the junior to about 375 A.D., and it is not definitely known whether the above explanation was given by the senior or the junior Bhadrabahu ; but the above exposition is usually ascribed to the senior Bhadrabahu of the 4th century B.C.[4] There is indisputable mention of *syadvada* in the *Nyayavatara* of Siddhasena Divakara[5] (about

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[2] Satis Chandra VIDYABHUSANA, *A History of Indian Logic* (Calcutta University 1921), pp. 167. (This book will be referred to as *HIL*.)

[3] *HIL*, pp. 167-168.

[4] *HIL*, p. 167.

[5] *HIL*, p. 181 : [It is the perfect knowledge of things taken from all possible standpoints. Thus a thing may be, may not be, both may or may not be, etc. according as we take it from one or the other standpoint.]

480-550 A.D.). A little later Samantabhadra (about 600 A.D.) gives a full exposition of the seven parts of *Syad-vada* or *Sapta-bhanginaya* in his *Aptamimamsa*.[6] It is clear that *syadvada* was well developed by the sixth century A.D., and received a great deal of attention in the mediaeval period of Indian logic ; the *Syadvadamanjari* of Mallisena (1292 A.D.), for example, is a separate treatise on the same theory.[7] There are, of course, still later works such as Vimala Dasa's *Saptabhangitarangini* and a large number of mediaeval and modern commentaries. I am, therefore, dealing with a well-known theme which is considered to be the most original contribution of Jaina logic to Indian thought.[8]

2. *Dialectic of seven-fold predication*

2.1. I shall next refer to the actual text in Sanskrit of the dialectic of seven-fold predication (*saptabhanginaya*):

(1) *syadasti*[9] = may be, it is not.
(2) *syatnasti* = may be, it is not.
(3) *syadasti*[10] *nasti*[11] ca = may be, it is and it is not.
(4) *syadavaktavyah*[12] = may be, it is indeterminate.
(5) *syadasti ca*[13] *avaktavyasca*[14] = may be, it is and also indeterminate.

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[6] *HIL*, pp. 182-184.

[7] Jadunath SINHA, *History of Indian Philosophy* (Central Book Agency, Calcutta, 1952), Vol. II, p. 179. (This book will be referred to as J. SINHA, HIP).

[8] Satkari MOOKERJEE : *The Jaina Philosophy of Non-Absolutism* (Bharati Jaina Parisat, Calcutta, 1944), p. 191 (This book will be referred to as *JPN*).

[9] The two words *syat* (may be) and *asti* (it is) are compounded (by rules of pronunciation) in one compound phrase *syadasti*.

[10] *nasti*=not-is or it is not.

[11] The compound-phrase consists of two words *syat* (may be) and *avaktavyah* (or inexpressible, or indeterminate).

[12] *ca*=and or also.

[13] By rules of pronunciation the two words *avaktavyah* and *ca* are compound into *avaktavyasca*.

[14] For example, Satis Chandra VIDYABHUSANA in *HIL* and other works.

(6) *syatnasti ca avaktavyasca* = may be, it is not and also indeterminate.
(7) *syadasti nasti ca avaktavyasca* = may be, it is and it is not and also indeterminate.

2.2. The word *syat* has been translated as [may be] but this does not bring out the full implications. The Sanskrit word in mentioning one possibility has also some indirect allusion to other possibilities. The Sanskrit word *asti* may be rendered as [it is], [it exists], or [it is existent]; and *nasti* is the negation, i.e. [it is not], [it does not exist], or [it is non-existent]. The third category predicates the possibility of both *asti* and *nasti*; of both [it is] and [it is not]. The first three categories conform thus to the categories of classical logic and do not present any difficulty.

2.3. The fourth category is *avaktavya* which I have translated as [indeterminate]. Other authors have used the words [indescribable],[15] or [inexpressible] or [indefinite]. For example, Satkari Mookerjee explains [The inexpressible may be called indefinite] ... (JPN, p. 115). I prefer [indeterminate] because this is nearer the interpretation which I have in mind.

2.4. It will be useful if at this stage I give an illustration. Consider the tossing of a coin; and suppose it turns up [head]. We may then say (1) [it is head] (now). This also implies, (2) [it is not-head] (on some other occasion). The third category follows without difficulty, (3) [it is, and it is not] which is a synthetic predication based on both (1) and (2). The fourth category predicates that the position is still (4) indeterminate.

2.5. This, however, does not exhaust the possibilities of predication or modes of knowledge. For example, if we know that it is a coin which has [head] on one side and [not-head] or [tail] on the other side, and we also know that it must turn up either [head] or [tail], we may then predicate that (5) there exists one type of indeterminateness which is capable of being resolved in terms of the first four categories. On the other hand, we may know that the subject of discourse is not a coin but something else to which the category of indetermination in the above sense cannot apply, we may then use the sixth mode of predication and assert that (6) there does not exist that type of indeterminateness which is capable of being resolved in terms of the first four categories. Finally, there is the seventh mode of knowledge where we may be able to predicate that sometimes the possibility of resolution of indetermination exists (as in the fifth mode) and sometimes this possibility does not exist (as in the sixth mode).

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[15] *Nyayavatara* edited by Satis Chandra VIDYABHUSANA. (Indian Research Society, Calcutta, 1909), pp. 29-30.

2.6. According to *syadvada*, the above seven categories are necessary and are also sufficient so that they exhaust the possibilities of knowledge. There is a minority view which holds that there are further possibilities of (8) *vaktavyasca avaktavyasca*, a kind of duplicated indeterminateness together with successive categories of the fifth, sixth and seventh types in an infinite regression but the accepted opinion is that the hypothetical eighth category is identical with the fourth so that there is no need of more than seven categories.

2.7. I should like to emphasize that the fourth category is a synthesis of three basic modes of [it is] (assertion), [it is not] (negation), and inexpressible, or indefinite, or [indeterminate] (which itself is resolvable into either [it is] or [it is not], and supplies the logical foundations of the modern concept of probability. Consider the throw of a coin. It was the possibility of head (it is) or not-head (it is not); sometimes head and sometimes not-head; and the combination of both possibilities of [it is] and [it is not] in an yet indefinite or indeterminate form. The fifth category of knowledge in Jaina logic predicates the existence of indetermination (which we may perhaps interpret, in modern language, as the assertion of the existence of a probability field). The sixth category denies the existence of a probability field; while the seventh category covers the whole range of possibilities mentioned in the other six categories.

3. *Relativism*

3.1. It would be of interest to consider some further aspects of Jaina logic. The points to be stressed are that Jaina thought is non-absolutist (that is, it is relativist) and realist. Siddhasena Divakara (480-550 A.D.) in *Nyayavatara* (which is accepted as the earliest Jaina work on pure logic at present available) gave an exposition of *syadvada* (knowledge of the all-sided method) of which the authentic text is as described below :

[*Syadvada*, which literally signifies assertion of possibilities, seeks to ascertain the meaning of things from all possible standpoints. Things are neither existent nor non-existent absolutely···· *Syad* which signifies (may be) denotes all these seven possibilities, that is, things may be looked at from one of the above seven points of view, there being no eighth alternative].[16]

3.2. It has been pointed out that :

[All objects are muiltform (*anekanta*) according to him (i.e. the Jaina). From their many-sided nature it follows that all judgments are relative. They are true under certain conditions. They are conditional or hypothetical. No judgments are absolutely true. The word [perhaps] must be added to all judgments to indicate their conditional character. This is *Syadavada* or the doctrine of relativity of judgments].[17]

[The Jainas emphasize manifold nature of real things which are endowed with infinite qualities, modes, and relations to the other things.[18] They have identity-in-difference. The Vedantists emphasize pure identity and deny plurality. The Jainas emphasize manifoldness of inter-related reals and deny pure identity. They are anti-Absolutists. They are advocates of relative pluralism].[19]

3.3. It has been also pointed out that :

[Thus the Jainas hold that no affirmation, or judgment, is absolute in nature, each is true in its own limited sense only, and for each one of them any of the above seven alternatives (technically called *saptabhangi*) holds good. (See *Syadvadamanjari* with Hemacandra's commentary, p. 166 etc.). The Jainas say that other Indian systems each from its own point of view asserts itself to be the absolute and the only point of view. They do not perceive that the nature of reality is such that the truth of any assertion is merely conditional, and holds good only in certain conditions, circumstances, or senses (*upadhi*). It is thus impos-

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16. J. SINHA, *HIP*, vol. II, 1952, pp. 205-206.
17. It is worth noting that the Jaina view in this respect has much similarity to A.N. WHITEHEAD'S [inexhaustibility of nature]. Also cf. V. I. LENIN : [*Materialism and Empiriocriticism*.]
18. J. SINHA, *HIP*, vol. II, 1952, p. 208.
19. S. DASGUPTA, *History of Indian Philosophy*, vol. I, pp. 180-181 (Cambridge University Press, 1922).

sible to make any affirmation which is universally and absolutely valid. For a contrary or contradictory affirmation will always be found to hold good of any judgment in some sense or other. As all reality is partly permanent and partly exposed to change in the form of losing and gaining old and new qualities, and is thus relatively permanent and changeful, so all our affirmations regarding truth are also only relatively valid and invalid. Being, non-being and indefinite, the three categories of logic are all equally available in some sense or other in all their permutations for any and every kind of judgement. There is no universal and absolute position or negation, and all judgments are valid only conditionally].[20]

4. *Realism*

4.1. Jaina logic is essentially realistic : [The Jaina philosopher maintains that existents are possessed of an infinite number of attributes and characteristics which can be discovered by experience alone.... He refuses to put a premium on internal intuition. The mind, even with its active contributions, which the Jaina does not seek to deny, is believed by him to be an instrument of discovery and not a creator of facts.] (JPN, p. 1)

[Logic has to work upon the data of experience and is as much an instrument as experience is.] (JPN, p. 5). [Pure logic, prior to and independent of experience, is a blind guide to the determination of truth. Logic is to rationalize and systematize what experience offers.] (JPN, p. 78).

[A thing is existent, is non-existent and is both existent and non-existent, but always subject to limitations imposed by objective differences of substance, time, space and attributes (*dravya-ksetra-kala-bhavapeksaya*).[21] The differences in predication are not due to our subjective contemplation from different angles of vision, but are facts irrespective of the consideration whether we contemplate them or not.] (JPN, p. 107).

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20. *dravya*=substance ; *ksetra*=space ; *kala*=time ; *bhava*=attribute.

21. I may draw attention to the similarity of these ideas to the concept of an [individual element] in relation to the [population] in modern statistical theory.

4.2. [The Jaina does not see any reason why things should be particulars alone. Things are, according to the Jaina, both universals and particulars together.... A real is a particular which possesses a generic attribute.] (JPN, p. 2)... [in conformity with the plain verdict of experience, the nature of reals is admitted to be made up of both the elements—universal and the particular and to be cognised as such by perceptual knowledge.]... (JPN, p. 3).

[Things are neither exclusively particulars, not are they exclusively universals, but they are a concrete realization of both. The two elements can be distinguished by reflective thought, but cannot be rent asunder. So our experience of one particular individual is not confined to that individual alone, but extends to unperceived individuals also in so far as the latter typify the universal as a part of their constitution. Individuals, even when they belong to a class, will vary from one another...Repetition of experience only helps us to take stock of the universal in its true character, but once the latter is known, it does not stand in need of verification or confirmation by further observation.[22]] (JPN, p. 6).

4.3. The Jaina emphasizes the multiple nature of reality and accepts the standpoint of non-absoutism : [He asserts that neither unity nor diversity sums up the nature of a real, but both taken together do it. Unity is not exclusive of diversity or *vice versa*. The difficulty that is confronted is not grounded upon objective reality, but arises from a subjective aberration, which consists in the imagination of inconsistency between unity and diversity. But unity is associated with diversity and diversity is never found apart from unity, which is its very foundation.] (JPN, p. 58).

[The central thesis of the Jaina is that there is not only diversity of reals, but each real is equally diversified. Diversification as induced by relations has been explained. The conclusion is legitimate that each real is possessed of an infinite number of modes at every moment. The number of reals is infinite and consequently their relations with one another are infinite...all things are related in one way or the other and...relations induce relational qualities in the relate, which accordingly become infinitely diversified at each moment and throughout their career... Things are neither momentary[23] nor uniform[24]]...(JPN, p. 70). According to the Jaina [a real changes every moment and at the same time continues. The continuity never breaks down] (JPN, p. 70).

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[22] There is one well-known school of Buddhist philosophy which holds that reality consists of an infinite sequence of [atomistic] or completely independent [moments] which have no connexion with one another.

[A real is that which not only originates, but is also liable to cease and at the same time capable of persisting. Existence, cessation, and persistence are the fundamental characteristics of all that is real... This concept of reality is the only one which can avoid the conclusion that the world of plurality, which is the world of experience, is an illusion.] (JPN, p. 72).

4.4. The relativism of the Jaina philosopher is to be sharply contrasted with some of the other Indian systems of philosophy.

[The Vedantist starts with the premise that reality is one universal existence ; the Buddhist fluxist[25] believes in atomic particulars, each absolutely different from the rest and having nothing underlying them to bind them together. The Naiyayika[26] believes both to be combined in an individual, though he maintains that the two characters are different and distinct... The Jaina differs from them all and maintains that the universal and the particular are only distinguishable traits in a real, which is at once identical with and different from both.] (JPN, p. 13).

It is, however, necessary to notice that :

[There is a difference—and intrinsic difference at that—between a manifested and an unmanifested real... They are identical and different both—idential in so far as it is the same substance and

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23. On the other hand, the monistic philosophy of the Vedantist holds that the Absolute transcends all change.
24. The phrase [fluxist] requires a little explanation. The Buddhist school of philosophy (to which reference has been made in footnote 1) is known as *ksana-vada* which means literally the theory or philosophy of [moments]. It has been translated by S. Mookerjee as [fluxist] which, however, does not seem to be entirely happy.
25. Another well-known school of Indian philosophy.
26. It may be noted that a single or unique individual as such (that is without any relation to a [population] or [universe]) has no meaning in modern statistical or probability theory.

different in so far as it undergoes a change of characteristic. This is the Jaina position of non-absolutism.] (JPN, p. 39).

[A real is not entirely expressible in all its aspects and modes. But it is not inexpressible altogether. A real being a multiple entity is expressible and inexpressible both in reference to different aspects ; it is expressible in so far as it partakes of a universal and is inexpressible so far as it is a unique individual.][27] . . . (JPN, p. 113).

[The unique individuality of a real is not accessible to conceptual thought and, hence, to language, but it is reached by an analysis of the nature of reality as it is apprehended in perception] . . . we have tried to prove, following the guidance of the Jaina philosophers, that the nature of reals, on analysis, has been found to exhibit the following traits, viz., existence, non-existence and inexpressibility. (JPN, p. 127).

5.1. Relational aspects have received special notice in Jaina logic.

[Everything is related with every other thing, and this relation involves the emergence of a relational quality. The qualities cannot be known *a priori*, though a good number of them can be deduced from certain fundamental characteristics.] (JPN, p. 3).... [A real is only a part of a system knitted together by a network of relations, from which it cannot be divorced.] (JPN, p. 109). (Every real is thus hedged round by a network of relations and attributes, which we propose to call its system or context or universe of discourse, which demacrates it from others) (JPN, p. 114).

[It is idle to raise questions of chronological status as to whether the unity is prior to the elements or the elements are prior to the unity. In the concrete real at any rate they are coordinate. This unity of being and non-being or rather of self-being and negation of other-being, is beyond the reach of logical concepts, and, hence, of linguistic symbols, which are but the vehicles of such concepts. The Jaina in recognition of this inalienable character of reals declares them to be inexpressible.

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27. The Jaina view insists on the inadequency of formal logic by introducing the concept of indefiniteness or indetermination or uncertainty as an inalienable character of reals, but also emphasizes the possibility of defining reals in terms of existent or non-existent taken together.

The inexpressible may be called indefinite from the standpoint of formal logic. But this is not the whole character of a real. It is also expressible and logically definable as existent, as non-existent.][28] (JPN, p. 115).

[The Jaina conception of relation may be summed up as follows. Relations are objective verities which are as much given to intuition and to thought as the terms are. A relation has no objective status outside the terms. It is the result of an internal change in the nature of the terms. It is *sui generis* in that it cannot be placed under the head of identity or of difference, both of which are contained as traits in its being.] (JPN, p. 211).

5.2. The Jaina view of relatedness of the things is very naturally extended to the discussion of causality.

[. . .neither synchronism nor succession is believed by the Jaina to be the essential characteristic of causal relation. Causality is a relation of determination. The effect is that whose coming into being is necessarily determined by the being of another. The determinant is called the cause and the determinatum is called effect. The determinant may be synchronous with the determined or may be separated by an interval. . .] (JPN, p. 212).

[What is the organ of the knowledge of causality? The Jaina answers that it is perception of the concomitance in agreement and difference. . . The Jaina takes the observation of concomitance in agreement and in difference to be one observation. . . The Jaina posits a twofold cause for the perception of universal relation—an internal and an external condition. The internal condition is found in the developed state of our mind and the external condition is the repeated observation of the sequence of the two events.] (JPN, p. 217).

. . .[Such concepts as causality, substance, attribute and the like are no doubt the ways in which the mind works up the data of experience, but this does not mean with the Jaina that they are true of the mind only and not of the extra-mental reality which they purport to understand. The Jaina would take them to be the instruments of discovery of the nature of reality, internal and external, which render the same kind of service as the sense-organs do.] (JPN, p. 217).

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[28] Pure logic in the sense of formal logic.

. . . [The different categories, viz., the selves, matter, time, space and so on, are deductions from experimental data. They have been posited since general concepts presuppose their existence and since without these principles the data of experience cannot be organized into a system. These categories in spite of their general and comprehensive character are not only not inconsistent with the existence of individual entities, but on the contrary they are entirely based on the objective data. Without the individual existents these categories would be reduced to unmeaning class concepts. The affirmation of categories as objective principles is thus proof of the existence of individual reals, which are included within the ambit of these categories. Without the individuals forming their contents the categories would be empty and barren, and the individuals without the categories would be reduced to a welter of chaos. The Jaina is a believer in plurality no doubt, but that plurality is not an unrelated chaos. The plurality is a system inasmuch as each individual is cemented with the rest by definite bonds of relationship.] (JPN, pp. 299-300).

[From the analytic point of view (*paryayartkikanaya*) the world is an infinite plurality with their infinite variations and modes. But the analytic view does not give us the whole nature of reality as it is. It is partial picture that we derive of the word by means of such approach. The whole gamut of reality, however, reveals its universal unitive nature *as one existence* when it is envisaged from the synthetic angle of vision (*dravyarthikanaya*).] (JPN, p. 301).

[It seems legitimate to conclude that the universe is one existence which manifests itself, as substance (*dravya*) as it unifies the modes and attributes. The selfsame existence again reveals itself as Space in so far as it provides accomodation for the infinite plurality of existence within itself (*ksetra*). It is the same existence which manifests itself as Time (w.f. *kala*) in so far as it changes into aspects, as precedent and consequent, as earlier and latter, as present, past and future modes. It is the same existence that evolves as phases and modes, attributes and states. The substance, time, space, attribute and relation are thus evolved from the same existence. The different categories, thus viewed as functional variations on one principle, are no longer in a position of antagonism of indifferent isolation. (*Astasahasri*, p. 113).

The world of reals is thus not only plurality but a unity also. It is one universe that the Jaina metaphysics gives us. But the oneness is not secured at the sacrifice of the many, nor are the many left in unsocial indiffercence.] (JPN, pp. 301-302).

5.3. It has been observed that [Jaina philosophy is. . . entitled to be called the paragon of realism. If experience be the ultimate source of knowledge of reality and its behaviour, we cannot repudiate the plurality of things. The admission of plurality necessitates the recognition of the dual nature of real as constituted of 'being' and 'non-being' as fundamental elements. One real will be distinguished from another real and this distinction, unless it is dismissed as error of judgment, presupposes that each possesses a different identity, in other words that being of one is not the being of the other. This truth is propounded by the Jaina in that things are real, so far as they have a self-identity of their own unshared by others (*svarupasatta*), and they are unreal in respect of a different self-identity (*pararupasatta*). . . . The logic of Jaina is empirical logic, which stands in irreconcilable opposition to pure logic.][29] (JPN, p. 181).

5.4. J. Sinha (HIP., vol. II, p. 180) gives the following summary of Jaina philosophy : [The world is self-existent and eternal. All objects of the world are multiform (*anekanta*) and endowed with infinite qualities and relations (*anantadharmaka*). This is relative plurialism. The reality can be considered from different points of views or *nayas*. The *nayas* are the standpoints. . . . All judgments are relative and probable. No judgments are absolute. This is *syadvada*. There are seven ways of predication. This is called *saptabhanginaya*.][30]

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29. J. SINHA, *HIP*, vol. II, p. 180.

30. I think it is also proper to note the occasional occurrence of certain intriguing phrases in the mediaeval period of Indian logic. As an example, I am giving below what I myself heard about 20 years ago from the late Dr. Sir Brajendra Nath SEAL (the great Indian savant and the author of the *History of Positive Sciences of the Ancient Hindus* and other works who died in 1936). Dr. Seal told me that in a mediaeval Indian treatise there is a discussion about the practice of giving alms to Brahmins ; and the question is raised whether the recipients of the gifts are always deserving persons. It is stated in reply that the practice of giving alms can be supported because [only ten out of hundred recipients are underserving]. I do not know whether the

It is not strange that Jainas believe that [the different systems of philosophy are only partial views of reality. Jainism is the complete view of reality.] (J. SINHA, HIP, vol. II, p. 180).

6. *Some general observations*

6.1. I have given actual quotations from books on Jaina philosophy to convey the thoughts in their original form (of course, in English translation) without the bias of any subjective interpretations. I should now like to make some brief observations of my own on the connexion between Indian-Jaina views and the foundations of statistical theory. I have already pointed out that the fourth category of *syadvada*, namely, *avaktavya* or the [indeterminate] is a synthesis of three earlier categories of (1) assertion ([it is]), (2) negation ([it is not]), and (3) assertion and negation in succession. The fourth category of *syadvada*, therefore, seems to me to be in essence the qualitative (but *not* quantitative) aspect of the modern concept of probability. Used in a purely qualitative sense, the fourth category of predication in Jaina logic corresponds precisely to the meaning of probability which covers the possibility of (a) something existing, (b) something not-existing, and (c) sometimes existing and sometimes not-existing. The difference between Jaina [*avaktavya*] and [probability] lies in the fact that the latter (that is the concept of probability) has definite quantitative implications, namely, the recognition of numerical frequencies of occurrence of (1) [it is], or of (2) [it is not]; and hence in the recognition of *relative* numerical frequencies of the first two categories (of [it is] and [it is not]) in a synthetic form. It is the explicit recognition of (and emphasis on) the concept of numerical frequency ratios which

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above phrase is to be interpreted as a simple statement about the number of proportion of recipients who were found to be underserving or whether the phrase has any implications of a statistical or probabilistic nature. Dr. Seal's view was that the above phrase had some probabilistic significance but only in a latent or implied (but not explicit or developed) form. As the subject of mediaeval Indian logic is not my special field of study I have not had the opportunity of making more detailed enquiries. I am, however, mentioning this point because it may be worth while making some further researches in this matter.

distinguishes modern statistical theory from the Jaina theory of *syadvada*. At the same time it is of interest to note that 1500 or 2500 years ago *syadvada* seems to have given the logical background of statistical theory in a qualitative form.

6.2. Secondly, I should like to draw attention to the Jaina view that [a real is a particular which possesses a generic attribute]. This is very close to the concept of an individual in relation to the population to which it belongs. The Jaina view in fact denies the possibility of making any predication about a single and unique individual which would be also true in modern statistical theory.

6.3. The third point to be noted is the emphasis given in Jaina philosophy on the relatedness of things and on the multiform aspects of reals which appear to be similar (again in a purely qualitative sense) to the basic ideas underlying the concepts of association, correlation, and concomitant variation in modern statistics.

6.4. The Jaina views of [existence, persistence, and cessation] as the fundamental characteristics of all that is real necessarily leads to a view of reality as something relatively permanent and yet relatively changing which has a flavour of statistical reasoning. [A real changes every moment and at the same time continues] is a view which is somewhat sympathetic to the underlying idea of stochastic processes.

6.5. Fifthly, a most important feature of Jaina logic is its insistence on the impossibility of absolutely certain predication and its emphasis on non-absolutist and relativist predication. In *syadvada*, the qualification [*syat*], that is, [may be] or [perhaps] must be attached to every predication without any exception. All predication, according to *syadvada*, thus has a margin of uncertainty which is somewhat similar to the concept of [uncertain inference] in modern statistical theory. The Jaina view, however, is essentially qualitative in this matter (while the great characteristic of medern statistical theory is its insistence on the possibility and significance of determining the margin of uncertainty in a meaningful way). The rejection of absolutely certain predication naturally leads Jaina philosophy continually to emphasize the inadequacy of [pure] or [formal] logic, and hence to stress the need of making inferences on the basis of data supplied by experience.

6.6. I should also like to point out that the Jaina view of causality as [a relation of determination] based on the observation of [concomitance in agreement and in difference] has dual reference to an internal condition [in the developed state of our mind] (which would seem to correspond to the state of organized knowledge in any given context) and also to an external condition based on [the repeated observation of the sequence of the two events] which is suggestive of a statistical approach.

6.7. Finally, I should draw attention to the realist and pluralist views of Jaina philosophy and the continuing emphasis on the multiform and infinitely diversified aspects of reality which amounts to the acceptance of an [open] view of the universe with scope for unending change and discovery. For reason explained above, it seems to me that the ancient Indian-Jaina philosophy has certain interesting resemblances to the probabilistic and statistical view of reality in modern times.

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APPENDIX IV

C. *THE SYADVADA SYSTEM OF PREDICATION*

J. B. S. HALDANE

The search for truth by the scientific method does not lead to complete certainty. Still less does it lead to complete uncertainty. Hence any logical system which allows of conclusions intermediate between certainty and uncertainty should interest scientists. The earliest such system known to me is the *Syadvada* system of the Jaina philosopher Bhadrabahu (?433-357 B.C.). Mahalanobis (1954) has commented on it. A central feature of this system is the *saptabhanginaya* or list of seven types of predication. These are as follows.

(1)	*syadasti.*	May be it is.
(2)	*syatnasti.*	May be it is not.
(3)	*syadasti nasti ca.*	May be it is and is not.
(4)	*syadavaktavyah.*	May be it is indeterminate.
(5)	*syadasti ca avaktavyasca.*	May be it is and is indeterminate.
(6)	*syatnasti ca avaktavyasca.*	May be it is not and is indeterminate.
(7)	*syadasti nasti ca avaktavyasca.*	May be it is, is not, and is indeterminate.

Mahalanobis illustrated this from the throw of a coin, and held that it could serve as a foundation for statistics. However I wish to show that it arises naturally in simpler cases, including simple cases where the affirmative predication *asti* would be "This is hot", or "This is a man".

In any such case an uncertain judgement is usually somewhat quantitative, as in "I think this is a man, though it may be a statue." I therefore begin with a very abstract field, that of algebra. Here we may be certain of our answer. If $x+2=3$, then $x=1$. But if $x^2-3x+2=0$, then $x=1$ or 2. We cannot say that the probability that $x=1$ is greater than, less than, or equal to the probability that $x=2$. Further data may lead to either of these judgements. Five hundred years ago one might perhaps have spoken of indeterminate solutions of equations. Thus if $x^3-x^2+x-1=0$, $x=1$ or "plus-minus" $\surd -1$. The last two solutions were *avaktavya* (incapable of being spoken) until the invention of complex numbers. Today we can find better examples in the field of finite arithmetic.

Consider the finite arithmetic *modulo m*. The only admissible values of a variable are the m residues $0, 1, 2, \ldots m-2, m-1$, that is to say the possible remainders after division by m. For example *modulo* 5, $4+3=7=5+2$, so we write $4+3$ *is equivalent to* 2. And $4\times 3=12=2\times 5+2$, so we write 4×3 *is equivalent to* 2. Let us consider the theory of functions *modulo m*. We can define any function $f(x)$ by a table of the values which it assumes for the different admissible values of x. Thus the function $3x$ (*mod*.5) can be defined by the table 0, 3, 1, 4, 2. For example if $x=4$, $3x$ *is equivalent to* 2. Of course many other functions are identical with it. For example $3x^5$ *is equivalent to* x^9+2x^5 *is equivalent to* $3x$. A function which assumes all the admissible values unequivocally is called biunivocal[1], and it is easy to show that there are $m\,!$ biunivocal functions. However some functions are univocal, but their inverses are not. In this case some residues do not occur in the table, while others occur more than once. For example the table of $3x^2+1$ (*mod*.5) is 1, 4, 3, 3, 4. The number of univocal functions is "m" *to the power* "m" since each place in the table can be filled in m ways.

If a function is not univocal, but its inverse is univocal, we obtain a table such as that for x "*to the power* half", namely 0, 1 or 4, *mra*, *mra*, 1 or 4. Here I introduce the symbol *mra*, for *avaktavya*, for an undefined number. There is no number whose square (*mod*.5) is 2 or 3. *mra* may occur in a table as an alternative to a number. For example the function "e to the power x" is never integral when x is a residue other than zero. Nor is it integral for most values of x which are *avaktavya*, such as $\surd\ 2$. But it is integral for such numbers as log 2. Hence the table of "e to the power x" is 1 ; *mra* ; *mra* ; *mra* ; *mra* ; and 0, 1, 2, 3, 4, or *mra*. The last place in the table corresponds to $x=$*mra*. Similarly if we consider the function y defined by $y^3-y^2=x^2$, then we find the table

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[1] I have deliberately chosen a word with the same root (Latin *vox*= Sanskrit vak) as *avakta* [*avakatavya*].

0 or 1, *mra*, 2 or *mra*, 2 or *mra*, *mra*, 3 or 4 or *mra*.

For when $x=2$ or 3, $y^3-y^2-4=0$, so $y=2$ or 2 *plus-minus* $\sqrt{2}$, the latter two roots being congruent with $\frac{1}{2}(-1$ *plus-minus* $\sqrt{-7})$. These quantities are inexpressible (*avaktavya*) *modulo* 5. And when $x=$*mra*, $x^2=2, 3$, or *mra*, so y may be 3 or 4, as well as *mra*.

Thus for a full enumeration of functions *modulo m* we need a table with $m+1$ places corresponding to the residues 0, 1,2 . . ., $m-1$, and *mra*. In each place we can set one, or any number, of these symbols, but we must set at least one. So each place can be filled in "2 *to the power* $m+1$ *minus* 1" ways, for each of the $m+1$ symbols can be present or absent, except that all cannot be absent. Thus the total number of functions *modulo m* is ("2 to the power $m+1$ minus 1") whole to the power $m+1$, for example 62, 523, 502, 209 if $m=5$, as compared with only 120 biunivocal functions, and 3125 univocal. . . .

Now consider the simplest of the finite arithmetics, namely arithmetic *modulo* 2. There are only two elements, 0 and 1. Electronic calculators are based on this arithmetic. These machines are so designed that each unit, as the result of any instruction, will be active (1) or inactive (0) at any given moment. And it is possible, in principle, to predict whether it will be active or inactive. That is to say ambiguity is avoided, and the machine is designed to operate in terms of univocal functions. Nevertheless it is possible to provide such a machine with an instruction to which it cannot give a definite answer. It is said that some such machines, when given an instruction equivalent to one of the paradoxes of *Principia Mathematica*, come to no conclusion, but print 101010. . .indefinitely. Clearly a machine could be designed to print *mra* in such a case. It is obviously possible to design a machine which would print "0 or 1" in response to the instruction $x^2-x=0$. A machine with the further refinement suggested above would respond "0, 1, or *mra*" to the instruction "(x^2-x) cos x *equivalent* 0 (*mod.* 2)". Such a machine could give any of 7 responses, namely :

0, 1, *mra*, 0 or 1, 0 or *mra*, 1 or *mra*, 0 or 1 or *mra*.

These are the *saptabhanghinaya* with the omission of the syllable *syad*.

The Syadvada System of Predication

I now pass to an example where the *saptabhanghinaya* is actually applied in scientific research, and which I suspect is not far from what was in Bhadrabahu's mind. In the study of the physiology of the sense organs it is important to determine a threshold. For example a light cannot be seen below a certain intensity, or a solution of a substance which is tasted as bitter when concentrated cannot be distinguished from water when it is diluted. Some experimenters order their subjects to answer "yes" or "no" to the question "Is this illuminated?", or "Is this bitter?". If the experimenter is interested in the psychology of perception he will permit the subject also to answer "It is uncertain", or some equivalent phrase. The objection to this is that some subjects may do so over a wide range of intensities.

Now consider a subject who is shown a series of illuminated patches, some above his threshold of perception, some below it, and others very close to it, in a randomised series. We will suppose that he is in a steady state of sensory adaptation, that he replies in Sanskrit, and that he is aware that his answers will sometimes be incorrect. At any given trial he will answer "*syadasti*", "*syadavaktavyah*", or "*syadnasti*". After the second trial of a light of an intensity near the threshold he may have given two of these answers, for example "*syadnasti ca avaktavyasca*". After the third he may have given all three, though this is not very probable. The possibilities may be schematised as follows : [See next page]

It is clear that the seven possibilities are exhaustive. My only possible criticism of Bhadrabahu is this. If the subject has given two different answers he may be aware that there is a possibility that he will later give the third. Once he has given all three, no further possibility is open. It might therefore be argued that the seventh type of predication should be "*asti nasti ca avaktavyasca*".

On the hypothesis that the subject is in a steady physiological and psychological state, the probabilities of each of the three answers to any given stimulus are constant. Let the probabilities of answering *syadasti*, *syadavaktavyah* and *syatnasti* be p, q, and

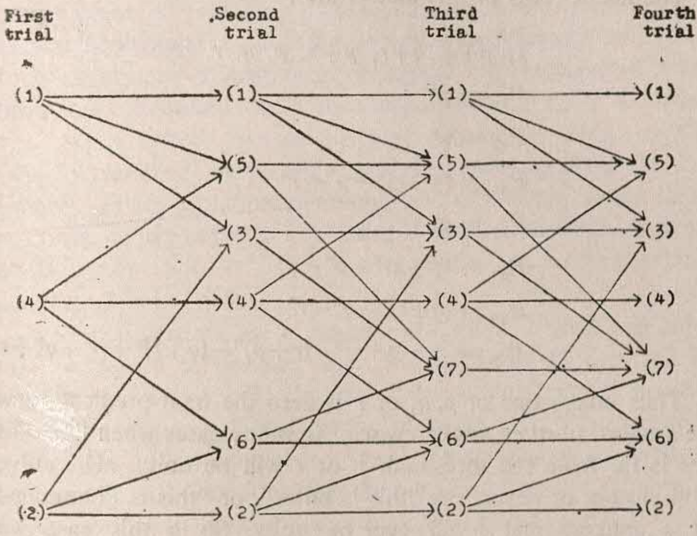

Diagram showing the possible sequences of predications. After the third trial no new possibilities arise.

r. where $p+q+r=1$. If, after *n* trials the probabilities of the seven types of predication are "p *suffix* 1, *n* ; p *suffix* 2, *n* ; etc," where p *suffix* 1, *n* is the probility of *syadasti*, etc., then the vector (p *suffix* 1, *n* ; p *suffix* 2, *n* ; . . . p *suffix* 7, *n*) is transformed into the vector (p *suffix* 1, *n*+1 ; p *suffix* 2, *n*+1 ; . . . etc.) by multiplication by the matrix.

$$\begin{matrix}
p & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & r & 0 & 0 & 0 & 0 & 0 \\
r & p & p+r & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & q & 0 & 0 & 0 \\
q & 0 & 0 & p & p+q & 0 & 0 \\
0 & q & 0 & r & 0 & q+r & 0 \\
0 & 0 & q & 0 & r & p & 1
\end{matrix}$$

Evidently this could be made a little more symmetrical by transposing row and column (3) and (4).

The latent roots of this matrix are :

$$1,\ p+q,\ q+r,\ p+r,\ p,\ q,\ r.$$

So

$$P_{1n}=p^n$$

$$P_{2n}=r^n$$

$$P_{3n}=(p+r)^n-p^n-r^n$$

$$P_{4n}=q^n$$

$$P_{5n}=(p+q)^n-p^n-q^n$$

$$P_{6n}=(q+r)^n-q^n-r^n$$

$$P_{7n}=1-(q+r)^n-(r+p)^n-(q+r)^n+p^n+q^n+r^n$$

Thus unless one of p, q, or r is zero the final predication will be *syadasti nasti ca avaktavyasca*. In many cases when the stimulus is far from the threshold, p or r will be unity. The subject will always, or never, say "this is bitter", or "this is illuminated". It is unlikely that q will ever be unity. So in this case *syadavaktavyah* will almost always be at best a provisional predication. It is however possible that p or r (say r) should be small, but not zero. If so "P *suffix* 5, n" will reach a maximum for some value of n and then decline. For example if $p=.6$, $q=.3$, $r=.1$, "P *suffix* 5" reaches its maximum value of .5184 when $n=4$.

I have dealt with a case which arises when the question asked is as simple as possible. Human judgements are generally more complicated. We may attend to the data of several different senses, and of our memories. Thus we arrive at one conclusion from one set of data, and another from another set. We say that wood is hard when compared with clay, soft when compared with iron, indeterminate when compared with similar wood.

The close analysis of vision with a dark adapted eye shows that in this case at least, Mahalanobis was correct in regarding the *saptabhanginaya* as foreshadowing modern statistical theory. It appears that when dark adaptation is complete, about five quanta of radiation must arrive within a short time in a small area of the retina before light is reported. Whether they will do so with a given intensity of illumination can only be stated as a probability. It is probable, though not by any means certain, that more complicated judgements depend on similar probabilities of events within the central nervous system.

Whatever philosophers of other schools may think, a Jaina can hardly object to regarding human predication as a special kind of animal behaviour. In this he agrees with followers of Darwin, such as myself. Attempts at a logical classification of animal behaviours frequently lead to a separation of "2 *to the power* n-1" types, where however n may exceed 3. Thus Haldane (1953) classified the possible results of learning in an animal as follows. In any situation an animal will, or will not, give a certain response R, say eating a particular type of food within a minute of its presentation, or lifting its leg within ten seconds after an auditory signal is given.

If we compare the set of possible situations in which an animal may be placed before and after an experience E, they fall into four categories, $r\,r$, rR, Rr, and RR. A situation $r\,r$ is one in which the response is not given before or after the experience. A situation $r\,R$ is one which it is given after E, but not before E, and so on. All situations may be $r\,r$. For example no-one has taught a dog to write. Some may be $r\,r$ and some $r\,R$. For example a dog which did not previously bring objects from the water to his master can learn to do so on command. In Pavlov's experiments a dog which previously only salivated (R) when given food will do so when certain auditory or other stimuli are given. Thus for such a dog all situations fall into the classes $r\,r$, RR, and rR. It can easily be seen that the effect of any experience on an animal can be classified according as the situations in which it can be placed fall into one, two, three, or all four of these classes. There are thus "2 *to the power* 4" -1, or 15 qualitatively different results of an experiment in which an attempt is made to alter an animal's behaviours. In this classification the animal is assumed never to give an indeterminate response. If it can do so, both before and after, there are, as I pointed out "2 *to the power* 9"-1, or 511 possible results. The same principles may be applied to the comparison of the behaviour of two different animals, or two different races or species.

It is foolish to pretend that ancient philosophers anticipated all modern intellectual developments. And I believe that we, today, can do more honour to their memories by thinking for ourselves, as they did, than by devoting our lives to commentaries on them.

But if we do so it is our duty to point out cases where it turns out that our own thought has run parallel to theirs. I was unaware of Bhadrabahu's existence when I wrote the paper to which I refer. The fact that I reached a conclusion so like his own suggests that we may both have seen the same facet of many-splendoured truth.

No doubt we reached it by very different methods, Bhadrabahu by meditation, I by thinking about the results of concrete experiments on animals. Such methods will often lead to different conclusions. This was the view of Warren Hastings in his introduction to Wilkins' translation of the Bhagavad Gita.

"But if we are told that there have been men who were successively, for ages past, in the daily habit of abstracted contemplation, begun in the earliest period of youth, and continued in many to the maturity of age, each adding some portion of knowledge to the store accumulated by his prodecessors, it is not assuming too much to conclude, that as the mind ever gathers strength, like the body, with exercise, so in such exercise it may in each have acquired the faculty to which they aspired, and that their collective studies have led them to the discovery of new tracks and combinations of sentiment, totally different from the doctrines with which the learned of other nations are acquainted : doctrines, which however speculative and subtle, still, as they possess the advantage of being derived from a source so free from every adventitious mixture, may be equally founded on truth with the most simple of our own".

If, on the other hand, the contemplation of one's own mind, and that of the minds of animals, lead to similar results, such results are, perhaps, worthy of serious consideration.

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APPENDIX IV

D. *THE COMPLEMENTARITY PRINCIPLE AND EASTERN PHILOSOPHY*

D. S. KOTHARI

The principle of complementarity, which we owe principally to Niels Bohr, is perhaps the most significant and revolutionary concept of modern physics.[1] The complementarity approach can enable people to see that seemingly irreconcilable points of view need not be contradictory. These, on deeper understanding, may be found to be complementary and mutually illuminating—the two opposing contradictory aspects being parts of a "totality," seen from different perspectives. It allows the possibility of accommodating widely divergent human experiences into an underlying harmony, and bringing to light new social and ethical vistas for exploration and for alleviation of human suffering. Bohr fervently hoped that one day complementarity would be an integral part of everyone's education and would provide guidance in the problems and challenges of life.

Hideki Yukawa was once asked whether young physicists in Japan, like most young physicists in the West, found it difficult to comprehend the idea of complementarity. He replied that Bohr's complementarity always appeared to them as quite evident : "You see, we in Japan have not been corrupted by Aristotle."

The core of the profound ethical and spiritual insights propounded in the Upanishads, Buddhism, and Jainism rests essentially on the complementarity approach to the problems of life and existence, though the formulations vary. Sri Aurobindo, perhaps the greatest exponent of the Upanishadic thought in our times, writes in his commentary on the Isha Upanishad :

> The principle it follows throughout is the uncompromising reconciliation of uncompromising extremes.... The pairs of opposites successively taken up by the Upanishad and resolved are, in the order of their succession : (1) The conscious Lord and phenomenal Nature ; (2) Renunciation and Enjoyment ; (3) Action in Nature and Freedom in the Soul;

> (4) The One stable Brahman and the multiple Movement; (5) Being and Becoming; (6) The Active Lord and the indifferent Akshara Brahman; (7) Vidya (Knowledge) and Avidya (Ignorance); (8) Birth and Non-Birth; (9) Works and Knowledge.[2]

The Jain formulation of the complementarity approach is based on the Syadvada dialectic (*Syad* means "may be").[3] The Syadvada logic is indispensable for the theory and practice of *ahimsa* (nonviolence) in thought, word, and deed. Syadvada and *ahimsa* go integrally together. Syadvada asserts that the knowledge of reality is possible only by denying the absolutistic attitude. What is new is the fact that relativity and quantum mechanics embody the same line of thought as one finds in the Syadvada logic. Further, the Syadvada approach enriches our understanding of complementarity in physics. As pointed out by P. C. Mahalanobis[4] and J.B.S. Haldane,[5] the foundations of the theory of probability are also in keeping with the Syadvada logic.

The recognition that in atomic phenomena we are concerned with an application of complementarity which can be precisely formulated provides a basic motivation for eventually discovering deeper and richer levels of complementarity encompassing both matter and mind. Bohr concludes his essay "Causality and Complementarity" as follows :

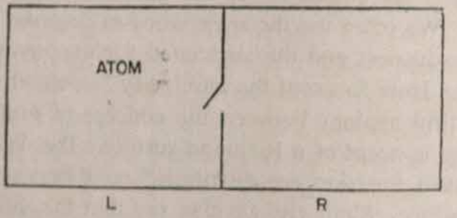
> In general philosophical perspective, it is significant that, as regards analysis and synthesis in other fields of knowledge, we are confronted with situations reminding us of the situation in quantum physics. Thus, the integrity of living organisms and the characteristics of conscious individuals and human cultures present features of wholeness, the account of which implies a typical complementary mode of description. Owing to the diversified use of the rich vocabulary available for communication of experience in those wider fields, and above all to the varying interpretations, in philosophical literature, of the concept of causality, the aim of such comparisons has sometimes been misunderstood. However, the gradual development of an appropriate terminology for the description of the simpler situation in physical science indicates that we are not dealing with more or less vague analogies, but with clear examples of logical relations which, in different contexts, are met with in wider fields.[6]

Bohr's first and continuing preoccupation with philosophical problems related to the use of language for unambiguously describing our experiences. A fundamental difficulty in this regard arises from the inescapable fact that man is both *actor* and *spectator* in the universe. Thus, when I am "seeing" a thing, I am also "acting" : my choice to see the particular thing is an "act" on my part. We often use the *same* word to describe both a state of our consciousness and the associated accompanying behaviour of the body. How to avoid the ambiguity? Bohr drew attention to the beautiful analogy between the concept of multiform functions and the concept of a Riemann surface : the different values of a multiform function are distributed on different planes of a Riemann surface. Similarly, we may say that the different meanings of the same word belong to different "planes of objectivity."[7]

Bohr used to tell how the ancient Indian thinkers had emphasized the futility of our ever understanding the "meaning of existence." And he would add that the one certain thing is that a statement like "existence is meaningless" is itself devoid of any meaning.

As lucidly pointed out by Heisenberg, the concepts of ordinary or natural language have undergone changes due to developments of modern science.[8] Further changes are to be anticipated as a result of continuing advancements. The ambiguities and contradictions faced in science have been attributed to the use of the terminology of natural language. Contradictions are inherent in natural language, as well as in precise scientific language. The role of the complementarity approach and of Syadvada logic is to give a less ambiguous meaning to the terminology of natural language and to provide greater insight into the relationship between human mind and reality.

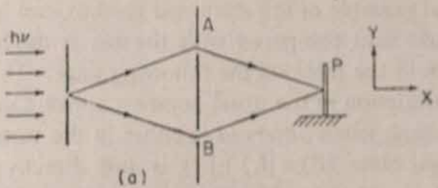
Consider the following idealized situation, or "thought experiment," discussed by Heisenberg.[9] There is an atom in a closed box that is divided by a partition into two equal compartments. The partion has a very small hole so that the atom can pass through it. The hole can be closed by a shutter, if desired. According to classical logic, the atom will be either in the left compartment (L) or in the right compartment (R). There is no third possibility. But quantum physics forces us to admit other possibilities to explain adequately the results of experiments. If we use the words "box" and "atom" at all, then there is no escape whatsoever from admitting that in some strange way, which totally defies description in words, *the same atom is, at the same-time, in both compartments* (when the hole is open). Such a situation cannot be expressed properly in ordinary language—it is inexpressible (except mathematically). As we shall see, it is

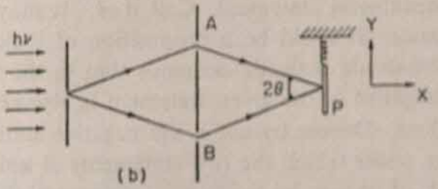


avayakta in the terminology of Syadvada. It is an idea crazy beyond words. But there is no escape ; for, totally unlike large objects, particles at the atomic level exhibit a wave aspect as well as a particle aspect. These two aspects, which are contradictory and mutually exclusive in the everyday domain, are complementary in atomic phenomena.

Bohr's famous analysis of a two-slit interference experiment made this complementarity quantitative.[10] The figure here shows a slight variant of the thought experiment involved. A plate *P* receives the photons. If, as in (a) in the figure, the plate is rigidly fixed, the interference pattern is built up by the arrival of many photons. But with a very weak beam, in which photons cross the apparatus one at a time, and with *P* suspended so that it can recoil along the *gamma* direction, as in (b), one might try to infer measuring the transverse momentum "plus-minus *hv theta/c*" transferred to *P*. This, however, will, by the Heisenberg indeterminacy principle, make the *gamma* coordinate of *P* uncertain by an amount "*delta gamma* greater than *h*/(*hv theta/c*)"; that is, "*delta gamma* greater than *lamda/theta*". But for observation of interference fringes, it is necessary that this uncentainty be less than the fringe spacing, which requires *delta gamma* to be less than *lamda/theta*. For interference fringes to be produced, photons must in some sense go through both holes, but this can happen only if we forgo any attempt to observe them. It is because of this mutual exclusiveness of the two steups (a) and (b) that the particle and the wave aspects are complementary and not contradictory.

A similar situation would apply if one observed Xrays scattered from the atom in the two-compartment box. One could either locate the atom as being in one compartment or the other, or one could observe an interference pattern arising from its partial presence in both compartments. Moreover, choosing at a given instant ("now") to make one type of observation or the other would seem to imply that this decision influenced the state of the atom at an earlier time (earlier by the transit time of Xrays from the atom to the plate).[11] This looks utterly strange. The lesson is that the behaviour of "small objects" is not visualizable. It is not describable in ordinary language. Nevertheless, it is real. As Wheeler has remarked : "There is no more remarkable feature of the quantum world [characterized by the Planck constant] than the strange coupling it brings about between future and past."[12] Every observation which implies a freedom of choice (that is, free will) between mutually exclusive alternatives is, in a sense, a participation in genesis (giving a new meaning to our being "actors" and "spectators" in the drama of existence). Perhaps, as we probe deeper in our understanding of nature, other levels of complementarity may be discovered.[13]





Let us now return to the Syadvada formulation as applied to the wave-particle duality.[14] According to the Syadvada scheme, every fact of reality leads to seven ways or modes of description. These are combinations of affirmation, negation, and inexpressibility—namely, (1) Existence, (2) Nonexistence, (3) Occurrence of Existence and Nonexistence, (4) Inexpressibility or Indeterminateness, (5) Inexpressibility as qualified by Existence, (6) Inexpressibility as qualified by Nonexistence, and (7) Inexpressibility as qualified by both Existence and Nonexistence.

The fourth mode—the inexpressibility known as *avayakt-[avy]a*—is the key element of the Syadvada dialectic. This is especially well brought out by the foregoing discussion of the wave-particle duality in modern physics. As mentioned earlier, Mahalnobis and Haldane have discussed the significance of Syadvada for the foundations of modern statistics.

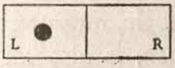
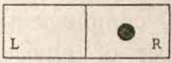
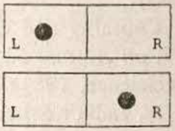
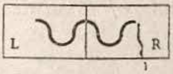
The physical example of the atom and the box can be presented diagrammatically and compared with the seven modes of Syadvada, as shown in the table on the following page. The quantum-mechanical description in the usual notation appears in the middle column. The atom when *observed* is either in the state$|L)$ or$|R)$. The *superposed* state $|P)=|L)+|R)$ is not directly observable using the type of apparatus for observing $|L)$ and $|R)$ states.

Take any meaningful statement. Call it A. It may describe a fact of experience. It could be a proposition of logic or mathematics. The Syadvada dialectic demands that in the very nature of things the negative of the given statement is also correct under certain conditions. Denote by *not-A* the negative statement of A. The conditions under which the two statements A and *not-A* are correct cannot, of course, be the same ; in general, the respective conditions are mutually exclusive. Given a statement A, it may not be at all easy to discover the conditions or situations under which *not-A* holds. It may even appear at the time impossible. But faith in Syadvada should encourage one to continue the search. For example, in Euclidean geometry the sum of the three angles of a triangle is equal to the sum of two right angles. The negation of this theorem is a new geometry in which the sum of the three angles of a traingle is not equal to the sum of two right angles. Not until two thousand years after Euclid was non-Euclidean geometry discovered, in the nineteenth century ; Einstein's theory of general relativity is based on this geometry.

For special relativity theory, the Syadvada approach is directly applicable.

An object traveling with any velocity is at rest with respect to an observer traveling with the object. Syadvada logic implies the existence of the negation of this proposition. Thus, according to Syadvada, there must exist an entity such that to imagine an

Seven modes of *Syādvāda*, illustrated by the example of an atom in a box with two compartments.

Atom in a box	*Quantum-mechanical representation (in the usual notation)*	*Syādvāda mode of description*
1. Atom in left compartment (L) 	System in state $\lvert L\rangle$	Existence (atom in L)
2. Atom in right compartment (R) 	System in state $\lvert R\rangle$	Nonexistence (in L)
3. Cases (1) and (2), *at different times;* or two similar boxes at the same time 	Mixture of $\lvert L\rangle$ and $\lvert R\rangle$ represented by $\lvert L\rangle\langle L\rvert+\lvert R\rangle\langle R\rvert$	Existence (in L) and Nonexistence (in L)
4. Atom in *both* compartments, at *the same time*; this wave aspect is nonvisualizable 	System in a state which is superposition of $\lvert L\rangle$ and $\lvert R\rangle$ $\lvert P\rangle=\lvert L\rangle+\lvert R\rangle$	*Avayakta* (Inexpressibility)
5. (4) and (1) at different times; or two boxes at the same time, one box for (4) and another box for (1)	Mixture $\lvert P\rangle\langle P\rvert+\lvert L\rangle\langle L\rvert$	*Avayakta* and Existence (in L)
6. (4) and (2), at different times; or two boxes at the same time	Mixture $\lvert P\rangle\langle P\rvert+\lvert R\rangle\langle R\rvert$	*Avayakta* and Nonexistence (in L)
7. (4) and (3), at different times; or three boxes at the same time	Mixture $\lvert P\rangle\langle P\rvert+\lvert R\rangle\langle R\rvert+\lvert L\rangle\langle L\rvert$	*Avayakta* and Existence and Nonexistence

The word *avayakta* in the above should be read as *avaktavya*.—D.C.]

observer traveling with it must imply a logical contradiction. Syadvada associates this with light, whose existence is the foundation of the relativity theory.

When we know that both *A* and *not-A* exist, we are ready to move on to a deeper layer or a new plane of reality corresponding to the simultaneous existence of both *A* and its negation. The new plane cannot be described in terms of the conceptual framework which described *A* and *not-A*. Syadvada logic, indispensable for ethical and spiritual quest and for *ahimsa*, is also of the greatest value for the advancement of natural science.

For the quest of truth—scientific, moral, and spiritual—what is most important is the Syadvada or the complementarity approach. The precise definitions and number of alternative modes are less important.

I would like to express my gratitude to Krishna Lal (National Physical Laboratory, New Delhi) and L.S. Kothari (University of Delhi) for their valuable suggestions during the preparation of this essay.

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2. Sri Aurobindo, *The Upanishads*, pt. 1 (Pondicherry, India : Sri Aurobindo Ashram, 1981), pp. 90-92.
3. Nathmal Tatia, *Studies in Jain Philosophy* (Banaras, India : Jain Cultural Research Society, 1951), p. 22.
4. P. C. Mahalanobis, "SANKHYA", *Indian Journal of Statistics* 18 (1957): 183ff.
5. J. B. S. Haldane, "SANKHYA", *Indian Journal of Statistics* 18 (1957): 195ff.
6. Bohr, *Essays, 1958-1962*, p. 7.
7. Leon Rosenfeld, *Physics Today* 16, no. 10, (1963): 47.
8. Werner Heisenberg, *Physics and Philosophy* (London : Allen & Unwin, 1959), p. 173.
9. *Ibid.*, p. 182.
10. See "The Bohr-Einstein Dialogue" in Part III of *Niels Bohr: A Centenary Volume*, ed. A. D. French and P. J. Kennedy, (Cambridge, Mass. and London, 1985).
11. See "Delayed-Choice Experiments" in Part III *ibid*.
12. John A. Wheeler, "Genesis and Observership", in Robert E. Butts and Jaakko Hintikka, eds., *Foundational Problems in the Special Sciences* (Dordrecht, Netherlands: D. Reidel, 1977), pp. 3-33.
13. D. S. Kothari, "Atom and Self," *Proceedings of the Indian National Science Academy* (Part A) 46 (1980): 1-28.
14. Idem, "Modern Physics and Syadvada," in Krishan Lal, ed., *Synthesis, Crystal Growth and Characterization* (Amsterdam : North-Holland, 1984), pp. 555-568.

APPENDIX IV

E. *SYADVADA*

PARTHA GHOSE

The science potential of the Jaina theory of *anekantavada*, particularly *syadvada* and *saptabhanginaya*, was first pointed out by P. C. Mahalanobis in the context of modern statistical theory. Mahalanobis' contention was that *syadvada* provided the right logical framework for modern statistical theory in a qualitative form, a framework missing in classical western logic. Later, J.B.S. Haldane wrote an article in which he claimed to have discovered a wider relevance of *syadvada* in modern science, particularly mathematics and experimental physiology. Lately, D. S. Kothari has written a valuable essay in which he points out the similarity between *syadvada* and Niels Bohr's *principle of complementarity*. In this context it would be worthwhile to analyse the positions taken by Mahalanobis, Haldane and Kothari vis-a-vis *syadvada* to arrive at a critical assessment of its relevance or otherwise in modern science.

To begin with, let us see what the traditional Jaina theory of judgement or *syadvada* says. Its fundamental tenet, based on experience, is that every object has innumerable characters or aspects, and that man can only look at an object from one particular point of view at a time and acquire only partial knowledge of it. Human judgement based on such partial and incomplete knowledge is called a *naya*. Failure to recognise this leads to conflicts based on the false belief that our judgements are unconditionally true. The resolution of such conflicts is achieved with the realization that apparently contradictory judgments about an object can often be reconciled in a more complete synthesis of its complementary features.

This is relativism, but relativism of a realistic kind, based not on the mood or fancy of the judging mind but on the inherent multifaceted nature of the reality itself. This is why the Jainas insist that every judgement must be qualified by the word *syat*, so that the limitation and conditional character of the judgement and the possibility of equally valid alternative judgements from other points of view are clearly acknowledged. However, the word *syat* has been translated to mean 'may be' by many, including Mahalanobis, Haldane and Kothari. According to D.M. Datta and S. Chatterjee (*An Introduction to Indian Philosophy*, Calcutta, 1960 ed.), this is a misunderstanding, because it leads to skepticism which is contrary to Jaina philosophy and ethics. They write, "It is not the uncertainty of a judgement, but its conditional or relative character, that is expressed by the addition of the qualifying particle 'syat'. Subject to the conditions of the universe of discourse under which any judgement is made, the judgement is valid beyond all doubt. There is, therefore, no room for skepticism". In science, in particular, there is no place for subjective uncertainties of judgement, except, perhaps, in experimental physiology. Viewed in this context, the whole thesis of Haldane would seem to be an unusual interpretation of the Jaina standpoint. Usually it is not the human "uncertainty" or vagueness of judgements as illustrated by Haldane with his examples from experimental physiology, that concerns *syadvada*. Such uncertainties are usually trivial. *Syadvada* is concerned with the deeper problem of reconciling contradictory judgements about an object or situation that are perfectly valid and certain under different physical conditions.

To avoid subjective relativism and skepticism, the word *syat* is to be understood to mean 'in some respect' or 'somehow'. Instead of saying, "The elephant is like a pillar", one should qualify this statement by saying, "In some respect (i.e. in respect of its legs), the elephant is like a pillar". Similarly, if one observes an earthen jug in a room, one should not declare, "The jug exists", but should rather say, "Somehow the jug exists" to signify that the judgement is true only relative to the many conditions of location, time, colour etc. under which the jug exists. This would rule out the possibility of the false inference that the jug exists everywhere at all times.

Now, what does the fourth form of judgement *avaktavyam* signify ? Let us consider a jar. It is black when raw and red when baked. If one asks, "What is the real colour of the jug under all conditions ?," the Jainas would reply, "The jar under all conditions is indescribable or *avaktavyam*". This is a very important and fundamental feature of *syadvada* in that it honestly and clearly recognises and admits of a category of valid judgements which is different from the usual affirmative and negative judgements and their compounds. As Datta and Chatterjee say, "This also points out that philosophical wisdom does not always consist in the ability to answer a question by a straight affirmative or negative, but also in realising that some questions, by their very nature, are unanswerable". Admission of this fourth form of judgement, coupled with the usual affirmative and negative judgements, leads to seven forms of judgement or *saptabhanginaya.* The Jaina is most insistent that "every aspect of everything must be viewed from every possible standpoint", and that complete knowledge lies in a synthesis of all possible partial standpoints.

With this background, we are now in a position to appreciate to what extent Mahalanobis' thesis holds. He starts off by categorically stating that he will accept a meaning of the word *avaktavyam* that is convenient for his purpose. Accordingly, he translates it to mean "indeterminate" and gives the example of the throw of a coin. One way of reconciling this with the traditional Jaina view outlined above is to look at the observational conditions involved. Since the observational conditions are designed to detect only one of two conditions, 'head' or 'tail' on the table, the spinning coin in the air cannot be said to be in either of these conditions throughout its trajectory—there are other states available to it. Hence, given that the two possibilites of 'head' and 'tail' exhaust all possibilities of the final observed state on the table, the state of the tossed coin in flight can only be described as indescribable or *avaktavyam* relative to them. In terms of the final outcomes, it can also be said to be in an 'indeterminate' state in that this indeterminacy is resolved in the end. Inherent in this indeterminacy is the qualitative concept of probability, as pointed out by Mahalanobis. However, it is difficult to agree with him that "All predication, according to *syadvada*, thus has a margin of uncertainty which is somewhat similar to the concept of uncertain inference in modern statistical theory". Such a view is based on reading *syat* to mean 'may be' rather than 'somehow' as explained earlier. The margin of uncertainty in modern statistical theory arises from the mere lack of sufficient data or information and not from any inherent limitation of principle.

The similarity of *syadvada* with Niels Bohr's complementarity principle is the most striking, as first noticed by Kothari. Although this principle arose from a need to interpret quantum reality, it is not a characteristically quantum idea as emphasised by Bohr himself. It also brings harmony to widely diverging human experiences. The particular situation that led Bohr to formulate it arose from the dual character of atomic particles (like, for example, electrons) which sometimes show a corpuscular character and sometimes a wave-like character. It goes to the credit of Bohr that, in spite of his training in Aristotelian logic, he recognised in this situation a totally new possibility excluded in classical logic. He was able to show convincingly by detailed and careful considerations of the experimental conditions involved that the corpuscular and wave-like characters of atomic particles were not absolute but conditional, i.e., revealed in different and *mutually exclusive* conditions. In other words, there is a whole class of experiments which are so set up that they can only register the corpuscular character of, say, electrons, and never their wave character, and at the same time there is a different class of experiments which can be so set up that they can never show up their corpuscular aspect but only reveal their wave-like character. That these observations do not contradict one another but rather reveal complementary aspects of the same physical entity, that is the electron, is the essence of Bohr's complementarity principle. It is strikingly similar to the Jaina view. Put in the Jaina manner of speaking, one would say, in some respect the election is a particle and in some other respect it is a wave. Both these views are correct, though each one is a partial judgement. The complete picture of an electron is obtained by a synthesis of these two judgements. If one asks, what is an electron like when it is not being observed, a Jaina would say, "*avaktavyam*".

Bohr always emphasized the importance of the use of unambiguous language. According to him, although one might experiment with atomic objects which behave totally differently from ordinary or classical objects, all experimental results must, in the final analysis, be expressed in a language that employs the clearly defined notions of classical physics. When one uses terms like 'particles' or 'waves', one must use them to mean what they usually describe in classical physics. Yet, the *explanation* of atomic phenomena so expressed is not possible within classical terms alone, and so need not conform to classical norms. For example, it is impossible to explain within classical physics how an electron can have a dual character. It is the recognition that classically valid observations can often require non-classical *explanations* that constituted Bohr's unique achievement. The quantum description involves an unobserved state of the electron which is neither corpuscular nor wave-like. Such a state cannot be described using the known language of classical physics without inevitably leading to contradictions and paradoxes. However, as pointed out by Kothari, it can be expressed mathematically as is done in quantum mechanics.

Such mathematical expression does not constitute a negation of Bohr's or the Jaina position on *avaktavyam* which really means 'indescribable by ordinary language'. In fact, although physicists freely and successfully use the mathematics of quantum mechanics to describe atomic systems when they are not being observed, their physical interpretation still continues to baffle veteran scientists. It is interesting to note that the use of such classically indescribable unobserved states ("potentialities") in quantum mechanics and their so-called 'collapse' or "actualisation" to one of the observed states on measurement inevitably leads to a statistical interpretation. The statistical nature involved here does not, however, arise from the lack of sufficient information but from a more fundamental limitation expressed by Heisenberg's famous Uncertainty Principle. According to this principle, the existence of Planck's quantum of action implies theoretical limits on the accuracy with which pairs of conjugate dynamical variables (like, e.g., position and momentum) can be simultaneously predicated. There is, therefore, an inherent uncertainty involved in the concept of an unobserved quantum mechanical state (a "potentiality") vis-a-vis the observable outcomes. The relevance to quantum mechanics of the *syadvada* concept of *avaktavyam* as interpreted by Mahalanobis to mean 'indeterminacy', with its consequent implications for probability, is therefore most striking, an aspect not commented on by either Mahalanobis or Kothari.

The *orthodox* interpretation of quantum mechanics (championed by Niels Bohr and his Copenhagen school) implies an enigmatic feature of quantum reality epitomised by Einstein's oft-quoted question, "Do you believe the moon isn't there when nobody looks ?" It is often claimed that the dynamical attributes of a system are *created* by the act of observation. When unobserved, an atomic system is usually in a "coherent" state of *superposition* (a "potentiality") as explained by Kothari with the example of an atom in a box. The act of observation or measurement "actualises" it by *collapsing* the superposed state into an "incoherent mixed state". Now, macroscopic objects like tables, chairs or the moon are always believed to be in such "mixed" states. What this means is that in an ensemble or collection of such identical objects, each one is in one of the possible states available to it. A measurement or observation simply *reveals* that state, as is the case with the moon. An atomic system, on the other hand, can be, when unobserved, in a "potential" or *superposed* state in which this is not true. A measurement *forces* the system to take up one of the possible states. In this sense one can say that the physical attributes are *created* by the observation. Now, since quantum mechanics is believed to be a universal physical theory, it should, as Einstein insisted, be able to explain the behaviour of both atomic and macroscopic objects. In particular, it should be able to distinguish atomic systems from macroscopic objects like the moon and explain why the latter never appear to be in superposed states. It is not clear as yet that it is able to do this in all cases.

Nevertheless, the subtle difference between ontology and epistemology in quantum mechanics is intriguing, a feature nonexistent in classical theories. What, if anything, has *syadvada* to say about this question ? Although *syadvada* is realism and is based on human experience with classical objects (atoms had only been inferred, not directly observed by the Jainas, and they do not seem to have considered atoms to behave essentially differently from ordinary matter), it admits of the *avaktavyam* which is closely analogous to *superposed* states. However, a 'baked' jar is red (not a superposition of red and black) whether one observes it or not. Hhere comes the interesting question : what is an *observation* ? Is it the registration of an object in a human consciousness that constitutes observation (as argued by a number of celebrated physicists like Eugene Wigner but not Niels Bohr) ? Or, can one do away with human consciousness altogether ? In the words of John Archibald Wheeler, "No elementary quantum phenomenon *is* a phenomenon until it is a registered phenomenon, brought to a close by an irreversible act of amplification. Definite as are the point of entry and point of detection of the photon, what it is doing in between is totally smoky. Equally smoky is any concept of the path of an electron through an atom. Termination of the smokiness by an act of detection is as close as we can get to establishing reality at the microscopic level." Being a realist approach, *syadvada* would also seem to rule out a subjective interpretation. It seems to be more in line with the realist interpretation of quantum mechanics which would say that human cognition is not essential—the physical attributes are *conditioned* by the total experimental or observational environment. A jar is red when baked and black when raw. The *redness* or *blackness* of a jar is *created* by the objective conditions of baking or rawness. There is no such thing as a 'red jar' at all times and in all conditions. Similarly, one can say that there is no such thing as an electron that behaves like a particle (or a wave) at all times and in all conditions. It is the experimental arrangement that determines which aspect of it will be manifested on a particular occasion.

It would, of course, be blatantly wrong to claim that the ancient Jainas anticipated all these sophisticated issues of modern science. On the other hand, Niels Bohr who formulated the Complementarity Principle, was totally unaware of *syadvada*. Yet, he arrived at something strikingly similar to it from entirely different considerations. This is presumably because the *logical* issues involved in synthesizing apparently contradictory but equally valid observations into a holistic view were really the same. In this sense, it would be legitimate to conclude that apart from its philosophical and ethical values and in spite of its different historical and cultural moorings, *syadvada* had a rich scientific potential which, however, remained unrealised for thousands of years. It was well ahead of its time in this respect.

The author is grateful to Dipankar Home for many clarifying discussions.

APPENDIX V

CRITICAL ANALYSIS OF THE MEDICAL COMPILATIONS

DEBIPRASAD CHATTOPADHYAYA

1. SCIENCE UNDER CENSORSHIP

By far the most extra-ordinary phenomenon in the situation of science in ancient India remains at best cursorily discussed by the modern scholars. While steps were being taken by the ancient physicians and surgeons to move towards remarkable results, the most intense contempt was shown for them in the legal literature, called Dharmasastra. This contempt was already pronounced when the law-codes were taking distinct shape in the sixth or fifth century B.C.

There was nothing subtle about it. It was sheer raw hatred. Nor was mentioned any reason for it. The damnation of the doctors was simply decreed. It was declared over and over again that they were inherently impure—so impure indeed as their very presence pollutes a place ; food received or given to them was said to be as filthy as blood and pus ; in social status they were considered no better than the whores, hunters and followers of other despicable professions.[1] The obvious need of their services for society was acknowledged of course,[2] as was that of the followers of other mean professions. Because, however, the healers were supposed to be absolutely shorn of respectability, it was prescribed that medical practice should better remain restricted to a caste which the law-makers were pleased to call the Ambasthas.[3] The low status of these Ambasthas was sought to be established by imputing to them a fanciful origin—the mating of Brahmin males with Vaisya females, which therefore simply meant that they were bastards of some sort (*varna-samkara*-s) in the caste norm.

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1. *Apastamba* i. 6. 19. 14 ffj *Gautama* xvii. 7 ; & 17 ; *Vasistha* xiv. 1-10 ; 19 ; etc., etc.
2. *Visnu* lxxi. 66.
3. *Manu* x. 46-7.

The earliest law-codes are associated with such names as Apastamba, Gautama, Vasistha and a few others. Modern authorities like P.V. Kane[4] propose the date sixth or fifth century B.C. for them. And practically all of them can be quoted to illustrate the legal contempt for medical practitioners. But it will be tiring to quote them—the almost endless repetition of the arrogant assertion that a doctor cannot but be a dirty man. It may be refreshing instead to quote the doctors, for whom personal cleanliness is an essential requirement of their own profession. Here is how the *Caraka-samhita* describes one fit for medical education :

> He should be peaceful (*prasanta*), noble in disposition, incapable of any mean act (*a-ksudra-karman*), with straight eyes, face and nose, with slim body, having a clean and red tongue, without distortion of teeth and lips, with clear voice (i.e. with voice neither indistinct nor nasal), persevering, without egotism, intelligent, endowed with powers of reasoning and good memory (*vitarka-smrti-sampanna*), with broad mind (*udara-sattva*), inclined to medical study either because of being born in the family of physicians or by natural aptitude, with eagerness to have the knowledge of truth (*tattva-abhinivesin*), with no deformity of body and no defect of sense-organs, by nature modest and gentle, contemplating on the true nature of things (*artha-tattva-bhavaka*), without anger and without addiction, endowed with good conduct, cleanliness, good habits, love, skill and courtesy (*sila-sauca-acara-anuraga-daksya-pradaksinya-upapanna*), desirous of the welfare of all living beings, devoid of greed and laziness (*alubdham analasam sarva-bhutahitasinam*) and having full loyalty and attachment to the teacher. (iii. 8. 8).

To this may be added from the *Susruta-samhita* the following description of the norm of the doctors :

> He should be cleanly in his habits and well shaved, and should not allow his nails to grow. He should wear white garments, put on a pair of shoes, carry a stick and an umbrella in his hands, and walk about with a mild and benign look as a friend of all created beings, ready to help all, and frank and friendly in his talk and demeanour, and never allowing the full control of his reason or intellectual powers to be in any way disturbed or interfered with. (i.10.2.B).

It is thus not at least in the norm of the medical man that one is allowed to sense so much filth which the law-givers impute to them. Evidently the filth is sensed elsewhere. From the legal

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4. P.V. Kane i. 2.

point of view it is in their commitment to natural science. Here is an interesting evidence from Manu (x.116) who is placed sometime between 200 B.C. and A.D. 200 and whose codification of the laws enjoyed the most widespread authority in the country.

According to Manu, certain modes of obtaining the livelihood are too derogatory to be normally allowed to the *dvija*-s or members of the privileged classes. Only under exceptional conditions causing dire distress, the law-giver grudgingly allows the *dvija*-s to go in for these. Their list, as given by the law-giver, is : *vidya silpam bhrtih seva goraksam vipanih krsih*, i.e. learning, crafts, wage-earning, servitude, cattleraising, shopkeeping, agriculture. Specially puzzling about this list is the item mentioned first, viz. *vidya*, which means 'learning' or cultivating some branch of knowledge. There is not much difficulty to understand why wage-earning, servitude, etc., are to be considered normally incompatible with noble birth. But what possibly is wrong about *vidya* or learning, so that a *dvija* should be advised to avoid it normally, or to accept it only under conditions of dire distress? The commentators Medhatithi and Kulluka Bhatta naturally feel that some clarification is necessary about this point. The clarification offered by both is quite striking. The word *vidya* or learning is to be understood here in a specific sense. It is learning or 'discipline' in its non-scriptural or anti-scriptural form, i.e. in the form in which the physicians, logicians, poison-removers, etc., understand it. As Kulluka Bhatta very pointedly says: *vidya vedavidya-vyatirikta-vaidyatarka-visapanayana-adi-vidya*—"by learning is meant here those specific forms of learning which are different from the learning of the Vedas, as for example the kind of learning cultivated by the physicians, logicians, poison-removers etc."

Two points about this clarification need specially to be noted. First, the kind of learning the physicians cultivate is not only characteristically different from scriptural learning but also derogatory from the standpoint of the latter. Hence, though the persons of noble birth are encouraged to cultivate learning in the scriptural sense, they are under normal conditions forbidden to study medicine. This is in full agreement with what the law-givers elsewhere declare : persons with noble birth must not go in for medicine. Secondly, to the general class of learning considered derogatory from the scriptural standpoint belong—along with medicine—certain other disciplines, two of which are specially prominent. These are learnings or *vidya*-s in the sense in which the logicians and poison-removers are specially concerned. There may not be anything odd in the mention of the poison-removers along with the physicians, because poison-removing is considered an important part of the ancient medical technique. But why is the mention of the logicians in the same context ? There is only one answer to this. In the law-giver's understanding, medicine and logic are very closely related. Here, at any rate, the law-giver's thesis is not fanciful. We have already seen how the physicians themselves fully approve of it. Accomplishment in logic is a necessary prerequisite for medical studies. At the same time, where the law-givers differ from the physicians must not be overlooked. The former detests logic and this for the simple reason that an excessive indulgence in logic encourages heresy or the tendency to question the scriptures. Assuming therefore that the commentators like Medhatithi and Kulluka Bhatta do not misunderstand Manu, we may see in the law-giver's declaration some indication of ideological considerations involved in the otherwise unexplained contempt for the physicians.

2. SOURCE OF CONTEMPT FOR SCIENCE

Precisely because it is apparently so quaint that the contempt for the healers is in need of fuller exploration. The main clue to it is to be found in the nature and source of the Dharmasastra-s.

Though professing to have absolute authority in matters concerning the law of the land, this literature originates in the priestly corporations and has the primary purpose of validating the ideal of the hierarchical society—an ideal of which the priests are the main theoretical custodians. The requirements felt for the purpose go flatly against those considered indispensible by the physicians for the defence and development of natural science. Hence is the tension between Dharmasastra and Ayurveda.

Let us try to have a fuller idea of the former first.

In these works, as Kane[5] shows, the word *dharma* already acquires the sense of "the privileges, duties and obligations of a man, his standard of conduct as a member of the Aryan community, as a member of the castes, as a person in a particular stage of life." The discussion of all these necessitates the clarification of many topics that belong to law in the later restricted sense. Some of these are : "the peculiar duties of the four castes, the responsibilities of the king, taxation, sources of ownership, treasure-trove, guardianship of minor's wealth, punishments for libel, abuse, assault, hurt, adultery and rape, theft in the case of several *varna*-s and rules about money-lending and usury and adverse possession, special privileges of brahmanas as to punishments, payment of debts, deposits, rules about witnesses, falsehoods when excusable," etc.

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[5] *Ib.* i. 14.

Had the *Dharmasutra*-s been concerned only with topics like these, they could have been considered "law literature" in our sense. But the fact is that over and above the discussion of all these, the texts also prescribe—usually with greater zeal—rules about many practices which more properly belong to the context of the religio-ritual techniques in which the ancient priests are most keenly interested.

Therefore, though in the course of time the *Dharmasutra*-s acquire absolute authority in legal matters, they actually represent Indian law still bound by the umbilical cord as it were with the ancient priest-craft from which these are born. As Winternitz puts it, "The Dharmasutras originated in the closest association with the literature of rituals (Vedangakalpa). This association with the literature of rituals is still wholly manifest in the Dharmasutras. Hence they are neither mere collection of rules, nor pure lectures on jurisprudence ; but they, with predilection, deal with religious duties of man. They form the constituent elements of religious and Vedic literature. They, exactly as the old manuals, had sprung up in the Vedic schools and were written by Brahmins, priests and scholars for the purpose of imparting instruction and were not written as codes for practical use in the courts of law".[6]

Thus, what comes down to us as law-codes of ancient India does not embody laws in the secular sense. These have their origin in the priestly manuals concerned mainly with ritual techniques and come down to us as completely dominated by the aims and aspirations of the ancient priest-class. Indian legal literature retains this character throughout its subsequent career. Much that is discussed in it are frankly the components of the religio-ritualistic complex and even what are declared in these as laws in the comparatively later sense remain under the commanding influence of this complex. Thus, in short, beginning from its earliest career of incomplete emancipation from the religio-ritualistic complex, Indian law-codes remain throughout their subsequent career under the spell of the ideology or manner of viewing things characteristic of the ancient priests.

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[6] M. Winternitz iii. 538.

Since the science policy of the Indian law-givers is the direct outcome of this ideology, we shall have to take note of some of its prominent features for a proper understanding of the law-givers' contempt for the physicians. For this purpose, we shall have to move backwards from the law-codes to the vast prose literature called the *Brahmana*-s and also to the *Yajurveda*, which are the earliest literary records of the class-conscious priests formulating their ideological requirements.

3. THE YAJURVEDA AND THE DEGRADATION OF ANCIENT GODS

The earliest priestly manual *par excellence* is the *Yajurveda*. It takes an all-absorbing interest in the priestly rituals, called *yajna*. In doing this it shows a very decisive turn in the Vedic tradition itself. Howsoever strongly it may be contested by the Brahmanical orthodoxy, this decisive shift in the Vedic tradition is so palpable that it can be questioned only by totally disregarding the actual Vedic texts. For our present discussion we are interested in this shift mainly in so far as it concerns the attitude to the doctors.

For understanding the nature of this changed attitude, we have to begin with a few words on the place of the healers and healing technique in the *Rgveda*.

An entire hymn of the *Rgveda*[7] is in praise of the healing herb or *osadhi*. The poet to whom it is attributed is mentioned as

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[7] *RV*. x. 97.

"the seer called Physician, son of the Atharvans"—*atharvanah putrasya bhisak-nama arsam*. We quote in rough rendering only two verses from it :

> Oh bright herbs, you are like the mothers. In your presence I promise to offer to the physician cows, horses, clothes and even myself...
>
> The wise physician is one round whom the herbs gather, in the way in which the chiefs gather round the king in the war-council. He wages war on sickness in all forms.

Can this "seer" of the Veda, remembered in the Vedic tradition by the name Physician, really see a distant future in which the law-giver like Manu, while pretending to have the highest reverence for the *Rgveda*, goes to the extent of declaring that the physician is so impure that even food offered to him becomes as filthy as pus and blood ? Evidently, whatever may be the source of this contempt for physician, it has no sanction in the ancient poetry of the *Rgveda*. There is in other words something palpably dishonest about the law-givers in so far as they want to justify their laws on the authority of the *Rgveda*. The fact on the contrary is, as I have elsewhere tried to show in some detail,[8] the really ancient songs that remain compiled in the *Rgveda* are totally unaware of the hierarchical society and therefore also of any ideological need to justify it with the contempt for the techniques and the technicians, to which healing and the class of healers belong.

The analogy used in the hymn just quoted is archaic no doubt. So also is the mythological imagination in terms of which medical practice is often eulogized in the *Rgveda*. What concerns our present discussion, however, is *the fact of eulogizing it* rather than the *way in which that is done*.

Some of the famous Vedic gods are specially praised in the *Rgveda* because of their skill in medical practice, or more simply for being outstanding physicians.

Rudra is invoked as the ablest of the physicians. "I have heard that you are the ablest of the physicians" : *bhisaktamam tva bhisajam srnomi*.[9] The same hymn specially praises the hands of Rudra with which he prepares medicines for all : *kva sya te*

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[8] D. Chattopadhyaya WLWD 139 ff.

[9] *RV*. ii. 33. 4.

rudra mrlayakuh hastah yah asti bhesajah jalasah—"Oh Rudra, where are your beautiful hands with which you prepare medicines benefitting all ?"[10] In another hymn, the same god is praised as lording over all the medicines that exist on earth : *yah visvasya ksayati bhesajasya.*[11]

Among the physician-deities of the *Rgveda* is included Soma, who treats the ailing ones on earth : *bhisakti visvam yat turam.*[12]

Varuna is eulogised as possessing a hundred *bhisajah*, which, as interpreted by Sayana, means either a hundred medicines or hundred physicians : *satasamkhyani ausadhani vaidya va santi.*[13] Along with Mitra, Varuna is connected with Soma and this in the sense of medicine for the ailing.[14]

Water—deified in Vedic imagination—is specially praised as containing remedies or medicines : "In the waters exists ambrosia, in the waters exist all medicines (*apsu bhesajam*). Let the sages be prompt in praise of waters. I am told by Soma that all the remedies exist in the waters (*apsu me somah abravit antah visvani bhesaja*).[15] In the custody of the All-gods (*Visvadeva*), water becomes the healing agent or medicine : *apah it va u bhesajih apah amivacatanih/apah sarvasya bhesajih tah te krnvantu bhesajam*—"Water itself is medicine : water causes the cure of diseases ; water is medicine for all diseases. Let that water act as medicine as administered by you."[16] In the same song wind or air is also eulogized as blowing in beneficial medicines.[17]

A song in praise of the Maruts says, "Oh dancing Maruts, with bright plates decorating your chests, men are moving towards you desiring your friendship . . . Oh Maruts, you are beautiful and magnanimous friends of ours, bring your medicines for us . . . Oh Maruts with beneficial rituals, aware as you are of medicines that exist in the Sindhu, in the Asikni, in the oceans and mountains—bring all these for the welfare of our bodies and instruct us in their use for curing sickness. Oh Maruts, cure those that are sick among us and remove their physical imperfections."[18]

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[10] *RV.* ii. 33. 7.
[11] v. 42. 11.
[12] viii. 79. 2.
[13] i. 24. 9.
[14] iii. 72. 17.
[15] i. 29. 19-20.
[16] x. 137. 6.
[17] x. 137. 3.

Many more examples like these may be easily quoted from the *Rgveda*. But that is not necessary. It is necessary only to note that all these do not represent any trend of stray thought in this vast collection of ancient hymns. These represent instead an important feature of the general theoretical temperament of the ancient poets, which they express by way of eulogizing their deities for the superb skill in medical practice or for being directly or indirectly connected with the healing agents. There is no doubt that this poetry is basically of the nature of wish-fulfilment on the part of the people with only rudimentary control over nature and as such it will be wrong to expect from it any impression of a sophisticated medical science. Indian medicine has indeed to develop a great deal in order to reach the stage represented by the *Caraka-samhita* and *Susruta-samhita*. But that is a different point. What we are concerned with at present is not the stage of development of medicine but *the attitude to it*. If the ancient hymns show that medicine has yet to cover a long course to be anywhere near the stage it attains in the classical compilations, these also show that the contempt for it characteristic of the law-codes of later times is not even remotely foreshadowed in these early songs. The reason for this seems to be that these songs or hymns are not the products of the hierarchical society and are hence without the need of an ideology more interested in controlling man than struggling with nature, an ideology of which the science-policy of the law-givers—specially their damnation of medicine—is the outcome.

If the earlier strata of the Vedic literature want us to correlate the absence of the hierarchical aspiration with the absence of an attitude that proves hostile to medicine, the comparatively later development of the same literature indicates a positive correlation between the presence of the two. When we move forward from the ancient hymns of the *Rgveda* to the comparatively later works belonging to the same literature, we see one of the most amazing transformations in ancient Indian history. Just as there emerges the hierarchical norm on the ruins of the early Vedic one still full of the memory of the collective tribal life, so also there emerges a new theoretical temper on the ruins of that of the early poets—a theoretical temper completely under the grip of the hierarchical aspirations, or, in the language of the *Brahmana* texts, the aspirations of the "lordly power" in collusion with the "holy power". From these aspirations follow the contempt for medicine and its practitioners. This contempt assumes indeed a very dramatic form, inasmuch as the priests of the later Vedic literature find it obligatory for themselves to degrade and denounce some of the ancient gods, and this on the specific ground of their medical past.

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[18] viii. 20. 20-6.

The gods thus degraded and denounced are the Asvins, who are physicians *par excellence* in the ancient Vedic mythology. We begin with some idea of their status in the *Rgveda*.

"Next to Indra, Agni and Soma," observes Macdonell, "the twin deities named the Asvins are the most prominent in the *Rgveda* judged by the frequency with which they are invoked. They are celebrated in more than fifty entire hymns and in parts of several others, while their name occurs more than four hundred times."[19]

Of their prominent qualities in the *Rgveda*, it is impossible to miss two. They are most "wonderful" and they are by nature "opposed to falsehood". "The two most distinctive and frequent epithets of the Asvins are *dasra*, 'wondrous', which is almost entirely limited to them, and *nasatya*, which is generally explained to mean 'not untrue' (*na-asatya*)."[20] Their aversion for untruth is indeed so fundamental that in the *Rgveda*, Nasatyas is freely used as an alternative proper name for them. Like many other gods, they are frequently described to have very great wisdom.[21] But the distinctive feature of this wisdom—like their wonder-works—appears to be their great knowledge and skill in medicine.

This is crucial for understanding the special glory of the Asvins in the mythological imagination of the early poets. We have just seen how in this mythology various gods are praised as superb physicians. Rudra, Soma, Varuna, Mitra, Ap, Maruts, Dyavaprthivi, Visvadevas and others are variously connected with medicine and its practice. Compared to the Asvins, however, their connection with healing appears to be secondary. In Vedic mythology, the Asvins are the greatest of the physicians. When the gods themselves are in need of medical help, they have to rush to the Asvins. And so do the mortals, for whom the Asvins are dearest specially in the capacity of healers.

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[19] A. Macdonell VM 49.

[20] *Ib*.

[21] *RV*. vi. 63, 5 ; viii. 8.2 ; x.93, 7 etc.

The Asvins are addressed as the physicians of gods—*daivya bhisaja*, which Sayana interprets as *devesu bhavantau cikitsakau*, "You two, who are the doctors of gods".[22] They also cure the diseases of all the suffering mortals.[23] It is because of this that they are so dear to the gods and men, in fact to everybody. As the refrain of one of the songs in praise of these "wonderful physicians" (*dasra bhisaja*) puts it, "May our friendship with you be never snapped ; may we be freed from diseases" : *ma nah vi yaustam sakhya mumocatam*.[24] The grand physicians, as the poets so intensely feel, are also the dearest friends of all.

A number of hymns of the *Rgveda*[25] describe the most "wonderful" feats of the Asvins. They rejuvenate the old, effect safe and painless delivery, give artificial limb to one who lost it, cure the burns, heal the wounds caused by leopards, etc. etc. Along with all these, the poets tell us how compassionate they are. "The story most often referred to is that of the rescue of Bhujyu, son of Tugra, who was abandoned in the midst of the ocean... The sage Rebha, stabbed, bound, hidden by the malignant, overwhelmed in the waters for ten nights and nine days, abandoned as dead, was by the Asvins revived... They delivered Vandana from calamity and restored him to the light of the sun, raising him up from a pit in which he lay hidden away as one dead... They succoured the sage Atri Saptavadhri who along with his companions was plunged in a burning pit by the wiles of a demon... The Asvins even rescued from the jaws of a wolf a quail which invoked their aid... They befriended Ghosa when she was growing old in her father's house by giving her a husband."[26] And so on.

The details of all these legends—like those of the obviously legendary accounts of the surgical and medical feats of the

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[22] *RV*. viii. 18. 8.

[23] *RV*. viii. 22. 10.

[24] viii. 86. 1-5.

[25] i. 116 ; viii. 22 ; x. 39.

[26] A. Macdonell VM 52.

Asvins—need not be taken at their face value. This is mythology, not history. Still, historically speaking, all these are not irrelevant, because they are undoubtedly indicative of a historical fact, viz. the general trend of the ancient Vedic thought. The poets dream of the model physicians as endowed not merely with the most wonderful medical skill and knowledge but also with a very strong compassion for all—a compassion that makes them the friendliest of all friends. To these the poets add that they have the firmest commitment to truth (*nasatya*).

The level of medical knowledge and technique in the *Caraka-samhita* and *Susruta-samhita* is understandably much higher than we can possibly expect in the ancient Vedic period. But at least a section of the later doctors seem to remain inspired by the image of the ancient Asvins—a composite image of skill and wisdom combined with the commitment to truth and compassion for all.

In the *Yajurveda*, however, it is all different. The Asvins are censured precisely for the reason for which the ancient poets of the *Rgveda* go ecstatic over their glory. The gods have to atone for their medical past in order to regain a place in the holy order approved of by the later priests. These priests moreover leave nothing vague about the need felt for censuring them. It follows clearly from their hierarchical aspirations. Medical practice demands of the ancient Asvins far more commitment to democratic values than can possibly be tolerated by the social norm which the priests are so anxious to validate. Bloomfield is about the only modern scholar to note this point. As he puts it, medicine is condemned in the *Yajurveda* because "the practice entails promiscuous, unaristocratic mingling with men".[27]

Accordingly, the *Yajurveda* formulates the rule in so many words that a Brahmin must never practise medicine. If therefore the later law-givers have any Vedic sanction for their condemnation of the physicians and their science, it is to be found in the *Yajurveda*. But the point is that the *Yajurveda* itself has to flout the more ancient Vedic values for the new purpose of condemning the physicians. In short, compared to the ancient times, the priests have a different ideological temper altogether. This temper proves inimical to medicine, i.e. to the ancient discipline with the greatest science-potentials because of its commitment to certain values found irreconcilable with the hierarchical norm.

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[27] M. Bloomfield in SBE XLII. intro. xl.

Of the two main versions of the *Yajurveda*—viz. *the White Yajurveda* and *Black Yajurveda*—the second one is preserved for us in a number of recensions. One of these is called the *Taittiriya-samhita*. We shall quote this first, because the priestly contempt for medicine and its practitioners is very clearly expressed in it. The context in which it is expressed is an apparently peculiar legend, according to which *Yajna* or the sacrificial ritual was itself once in need of medical attention, because "its head was cut". The legend occurs also elsewhere in the Vedic literature and some of the modern scholars have tried to discuss its possible significance.[28] More important for our purpose than this legend is the sacrificial formulas in the context of which the *Taittiriya-samhita* reiterates this legend. As one of these sacrifical formulas, the text[29] quotes a scrap of a Rgvedic verse[30] though, as Keith[31] shows, in a somewhat corrupt form. It invokes the Asvins : "... Oh Asvins, come hither to drink this *soma*". The *Yajurveda* prescribes that this Rgvedic scrap is to be recited as an appropriate incantation at a certain stage of performing the Soma sacrifice. But the texts of the *Black Yajurveda* give us not merely sacrificial incantations or formulas, to these are also added explanatory comments, which eventually become the special theme of the *Brahmana* texts. As an explanatory comment like this on the ritual use of the Rgvedic scrap, what the *Taittiriya-samhita* says is startling. In rough rendering, it is as follows :

> The head of the sacrifice was cut.
>
> The gods said to the Asvins : 'You are the physicians. Repair (replace) the head of the sacrifice.' (The Asvins seem to bargain for the medical service requisitioned).
>
> They replied, 'Let us choose a boon. Let there be a libation for us also herein.' (The implication evidently is that in this Soma sacrifice the Asvins are normally supposed to be denied of any share.)

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28. *Sat. Br.* xiv. 1. 1. 8ff. cf. Muir OST iv. 124.
29. *Tait. Sam.* 147.
30. i. 22. 1.
31. A.B. Keith VYS I. 54n.

> (The gods agreed to this.) They drew this libation for them—for the Asvins.
>
> Then indeed did they (the Asvins) repair the head of the sacrifice. In that (the libation) for the Asvins is drawn ; (it is) to restore the sacrifice.
>
> The gods said of these two : 'Impure are they, wandering among men as physicians.'
>
> Therefore, a Brahmin must not practise medicine, for the physician is impure—unfit for the sacrifice.
>
> Having purified them (the Asvins) by the Bahispavamana (stotra), they drew for them this libation for the Asvins. Therefore, the libation for the Asvins is drawn when (the purifying) Bahispavamana (stotra) has been sung. Therefore, by one who knows thus the Bahispavamana should be performed ; verily he purifies himself.[32]

Let us first try to be clear about the implications of this remarkable passage.

It is of the nature of a didactic or theological discourse on the ritual use of a morsel of a Rgvedic text. Read in its actual context, it gives us the obvious impression of a simple and unqualified admiration for the Asvins, which is characteristic of all the Rgvedic hymns mentioning them. But the theological discourse of the *Taittiriya-samhita* proposes to amend it. The reason for this proposed amendment is not that the Asvins suffer any loss of their wonderful medical skill ; the real reason on the contrary is that they are supposed to retain it. In other words, in the later priestly view, the Asvins remain excellent physicians—so excellent indeed that the gods have to approach them for healing the injured *yajna*. In this, the later priestly view continues to be the same as that of the ancient poets or "seers" of the *Rgveda*. Where the priestly view breaks away from the older one is another point. There is obviously something wrong—something polluting—about the Asvins, because of which they do not normally qualify themselves to receive the sacrificial share, as do the other gods. In the priestly way of thinking, bargaining is the normal thing to do. In accordance with this, in the priestly theology the Asvins are made to make a bargain, flouting again the Rgvedic spirit in which they cure the sick, moved only by the compassion and love for all. In the *Yajurveda*, the Asvins agree to render the medical service only on condition of being allowed a sacrifical portion. The other gods have to agree to this, though with some obvious reluctance. They are allowed the sacrifical share only after undergoing some process of ritual purification, i.e. after what the text calls purification by the Bahispavamana-*stotra*.

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[32] *Tait. Sam.* vi. 4. 9.

But what exactly is so wrong about these two ancient gods, so that they can be entitled to the normal status of the other gods only after being properly purified? This question is crucial for our present discussion. So also it is for the *Yajurveda* priests, who want to leave nothing vague about their answer to it.

The text says :

> The gods said of these two : Impure are they, wandering among men as physicians (*tau deva abruvan, aputau va imau manusyacarau bhisajau iti*).

To remove any possible uncertainty about the priestly norm, the text adds :

> The physician is impure, unfit for sacrifice. Therefore, a Brahmin must not practise medicine (*tasmat brahmanena bhesajam na karyam. aputah hi esah amedhyah yah bhisak*).

All this is most astounding. I am not aware of anything comparable to it anywhere else in world literature. The twin-gods once eulogized in the mythological imagination of the Vedic people for their medical skill are later declared as degraded precisely on the same ground. Such has been the calamitous consequence for natural science of the development of the hierarchical society and the zeal to eulogize its aspirations.

The same contempt for the ancient twin-gods, the Asvins, runs through the *Brahmana* literature and—evidently for mass consumption—reiterated in the *Mahabharata*. In the Dharmasastra-s it was unnecessary to reiterate the mythology of the gods. What was retained in these is only the crude contempt for medicine and its practitioners, senseless though it may appear to us.

4. GROUNDS FOR CONTEMPT FOR MEDICAL SCIENCE

Already in the passage quoted from the *Yajurveda*, we have some hint of why the priests were so annoyed with the healers—an annoyance which it knew to express mainly in terms of impurity and pollution. The healers were supposed to be intrinsically impure because their practice required of them the commitment to the democratic norm, or, as Bloomfield puts it, to that of the unaristocratic mingling with men. Democracy was understandably the limit that the spokesmen of hierarchical aspirations could tolerate.

But there was more in the law-makers' denunciation of the physicians and surgeons. There were a number of reasons that prompted the law-makers to take such a negative attitude to the medical science and its practitioners. We may note here some of these that are quite on the surface. Thus :

For the safety of the hierarchical society the law-makers felt that a number of restrictions were better enforced on the behaviour-pattern of the masses which, irrespective of their intrinsic worth, could keep them under the spell of superstition. Superstition had the acknowledged efficacy of keeping men under control. Of such superstitions, one of the most widely known is the reverence for the gods and Brahmins along with the allegedly holy animal, the cow (*deva-go-brahmana*).

The makers of rationalist medicine, by contrast, were much too committed to their ideal of curing the sick to remain crippled by such injunctions. From this point of view they could perhaps be somewhat indifferent to the question of having any reverence for the deities and Brahmins. But the question of the cow was a different one altogether. They observe with as much rigour as is possible for them that it has very definite medical efficacy. The beef, like certain other varieties of meat, is thus a must in their medical prescription for certain diseases. In doing this they are however confronted with a problem no doubt. Being fully aware of the fact that the religious, aesthetic and other considerations of the patient are likely to make him so intensely averse to these meats that even if he is forced to take these he was only likely to vomit these out.

What then is to be done ? The answer suggested in the *Caraka-samhita* is remarkable. To be a successful physician, one had to be a damn good cook—so good indeed as to make the meat preparation to be passed as a vegetable one. This is bluffing the patient no doubt or telling him a lie. But that does not matter. The only concern of the doctor is to cure the patient. That is the medical ethics for rationalist medicine. The question of truth and falsehood in their abstraction is one outside the interest of rationalist medicine.

All this appears to be quite extraordinary specially in the ancient Indian context. We may thus go in for some textual data showing how the *Caraka-samhita* puts the points. The first question obviously is :

What are the specific qualities of the cow's flesh ? Atreya answers : "The flesh of the cow is beneficial for those suffering from loss of flesh due to disorders caused by an excess of *vayu*, rhinitis, irregular fever, dry cough, fatigue, and also in cases of excessive appetite resulting from hard manual work."[33]

For patients suffering from emaciation due to pectoral lesions is recommended barey-meal with either the milk or meat-juice of the cow, buffalo, horse, elephant and goat (*go-mahisi-asva-naga-ajaih ksiraih mamsarasaih tatha*).[34] Some diseases are viewed as due to the excess of *vayu* in the body and since the cow's flesh is considered greatly beneficial in disorders due to excess of *vayu*,[35] the meat-juice of the cow—like that of various other animals—is recommended as a cure for these. "The meat-juices of iguana, fox, cat, porcupine, camel, cow, tortoise and pangoline should be prepared like vegetables and cooked *sali*-rice may be given with meat-juices for the relief of *vayu*."[36]

Since persons suffering from consumption are badly in need of adding flesh to their bodies and since the physicians think that the cow's flesh—like that of the other animals belonging to the *prasaha* class—is promotive of flesh and plumpness,[37] they freely recommend it for the consumptive patients, along with a number of alternatives to it. "The flesh of peacock, partridge, cock, swan, hog, camel, ass, cow and buffalo are greatly promotive of flesh."[38]

Thus notwithstanding the systematic effort of the law-givers to boost veneration for the cow—to declare that slaughtering the cow is a sin causing the loss of caste[39] and therefore demanding a prolonged penance[40]—the genuine physicians in our medical compilation appear to remain unconcerned. What interests them is a different point altogether : it is only the food-value of the cow's flesh, like that of the flesh of various other animals, for they think that the most important factor determining health is food.

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[33] i. 27. 79-80.
[34] vi. 11. 83.
[35] i. 27. 79.
[36] vi. 14. 126-27.
[37] i. 27. 56-7.
[38] vi. 8. 158.

This being a fundamental proposition for the physician, he has no scope to introduce any religious or other consideration into his view of food.

But there is a problem for the physician in recommending for the patients all sorts of flesh, their medical efficacy notwithstanding. He is fully aware of the possible strong disgust in the patient for at least some of these, provoked by the patient's religious, aesthetic or other sentiments. The revulsion for such flesh may be strong enough in the patient to lead him either to stubbornly refusing these or even to vomiting these out if forcibly administered. What, then, is to be done by the physician ?

The answer given in the Cikitsa-sthana immediately before what is already quoted—i.e. the recommendation of the flesh of swan, hog, camel, ass, cow, buffalo, etc.—is remarkable. The physician as physician is interested only in one thing, and that is the cure of the patient. If, therefore, it is essential for the patient to eat some flesh, the physician has to work out certain tactical method by which to lead the patient to overcome his religious or aesthetic revulsion against these. When necessary, such a tactical method may include deliberate deception or sheer bluff. It is thus not any absolute fidelity to traditional morality that makes one a model physician. What makes one so is also the occasional capacity to lie—though obviously in the patient's interest.

The entire discussion of this in the Cikitsa-sthana needs to be quoted here, for it has considerable theoretical interest for understanding the position of the real physician in the *Caraka-samhita.* What concerns him is medicine and medicine alone. If therefore there is any direct clash between medicine and morality in its abstract sense, the physician as physician cannot help choosing the former. For him there is no clash between scruple and medi-

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39. *Manu* xi. 60.
40. *Manu* xi. 109-17.

cine, for the real scruple that he is aware of is that of curing the patient. As the *Caraka-samhita*[41] puts it :

> For the emaciated consumptives continuing to lose flesh, the physician skilled in dietetics should prepare well-cooked dishes of meats of carnivorous animals. To the consumptives must be given the peacock's flesh and—in the name of the peacock's flesh—the flesh of vultures, owls and blue jays properly cooked in prescribed manner. In the name of partridge, give the flesh of crows ; in the name of the snake-fish, give the flesh of snakes ; in the name of intestines of fish, give fried earth-worms. In the name of rabbit-flesh, the physician may give dressed meats of fox, large mongoose, cat and jackal-cubs. For increasing the flesh in the consumptive patient, the flesh of lion, bear, hyena, tiger and similar carnivorous animals may be given in the name of the flesh of deer. For promoting the flesh of the patient, the meats of elephant, rhinoceros and horse—well-seasoned with spices—should be given. The flesh of birds and animals that have grown plump on flesh diet is an excellent flesh-increasing food. Being acute (*tiksna*), hot (*usna*) and light (*laghu*) it is specially beneficial. Those fleshes that are considered unpleasant by the patient because he is not used to them should be given to him with deceptive names. Then he readily takes these. But if their real nature be known, these will either be not eaten at all out of revulsion, or, even if eaten, will be vomited out. Hence these must be disguised and given under false name.

Can a physician—with a medical scruple as strong as to declare all this—be prevented by religious or other scruples to recommend the flesh of the cow in cases where he is convinced of its medical efficacy ? The fact is that the real physician in the *Caraka-samhita* shows no such inhibition. Immediately after the discourse on the need of occasionally deceiving the patient with false names of the meats served to him, we read the recommendation of the cow's flesh to the consumptive patient, along with the suggestion of various alternatives to it, like the flesh of the hog, camel, ass, buffalo etc.

All this does not mean that the *Caraka-samhita* shows any special fad for beef-eating, as some of the social reformers of nineteenth-century Bengal wanted deliberately to cultivate it as part of their struggle against superstition. From the medical viewpoint such a fad would be as a-scientific as the taboo against beef. Though without any inhibition against it, the text is also without any unscientific enthusiasm for it. As far as the ancient doctors understand, beef is not easily digested and, in this sense, undesirable among meats, just as wild barley is among grains furnished with awns, black gram among pulses, river water of the rainy season among waters, etc., etc.[42] But this is a medical view of undesirability and has nothing to do with the religious taboo against beef. When medically necessary, therefore, the doctors consider it a must for certain patients.

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[41] vi. 8. 149-57.

We have mentioned here only one example of how the medical ethics of the *Caraka-samhita* came in open confrontation with the demands of the law-makers. Many more examples like this can be quoted from the medical compilation.

But the confrontation of rationalist medicine with the political requirements of the law-makers seems to become sharpest when the former argues in defence of the intrinsic efficacy of medicine. We have already seen (see pp. 256ff) how this is argued in the *Caraka-samhita*, and also how in the course of this argument, our medical compilation speaks of four and just four factors of medicine: the physician, the substances (used as drugs and diets), the nursing attendant and the patient. While explaining the essential qualifications of these what rationalist medicine completely scraps by overt implication is the law of *karma*. This, from the viewpoint of the Dharmasastra is the limit of audacity, because the law of *karma* forms the indispensible assumption for justifying the hierarchical society which the entire corpus of the legal literature is intended to justify.

Here therefore was the real rub. The Dharmasastra is nothing if not a defence of the hierarchical society. Rationalist medicine, again, is nothing if not a defence of medical science. What then can the law-makers do but to condemn rationalist medicine and its practitioners ?

5. TECHNIQUE OF EVADING CENSORSHIP

To sum up the discussion so far : Judged in its ancient context the step towards rationalist medicine was about the most spectacular one in the history of science in ancient India. In the same context, however, it was a very risky step. The risk involved was frankly political. In defence of their own political philosophy supposed to ensure safety of the caste-divided society the lawmakers cannot but come out sharply against the doctors.

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[42] i. 25. 39.

What then the doctors do in defence of their science ? From the medical compilations in their present form the presumption is that they—or at least those through whose hands the compilations eventually passed—tried to evade the censorship of the lawmakers by way of paying heavy ransom to the demands of the latter. Thus we read today in the *Caraka-samhita* of the absolute validity of the Vedas, the defence of the theory of *karma*, the damnation of the heretics, long eulogy to the ideal of *moksa*, not to speak of sundry superstitions like the reverence for deity-cow-brahmin and what not. It would be tiresome to quote passages of the *Caraka-samhita* to illustrate all these. To any reader of the text the points are obvious. These leave us to wonder as to why such concepts should at all be there in a work on medical science, particularly when there are innumerable other works specializing in the discussion of all this. At the same time these cannot be purposeless. The purpose cannot obviously be medical which is motivated exclusively by the cure of the patients. It can thus be only extra-medical. But what kind of extra-medical purpose all these ideas and attitudes can possibly serve, specially when we find these embodied in the medical text ? The answer seems to be that in spite of going flatly against rationalist medicine these do help rationalist medicine by way of being used as a protective crust for the science.

It follows from what is argued that everything embodied in the extant compilations cannot be taken as indicative of genuine rationalist medicine. As a matter of fact, it is impossible to have a coherent idea of Ayurveda if all that we read in the medical compilations are taken in their face value. On the contrary, any proper understanding of rationalist medicine requires of us the discrimination between what is intrinsic and what is extrinsic to it in the compilations as finally codified.

However, what is at once necessary for such a discrimination is the criterion for the purpose. Lest however the criterion accepted runs the risk of being subjective—or motivated by the personal preference of the modern investigator—it is safe to seek for it within the *Caraka-samhita* itself. When we do so, we cannot but feel surprised by the extraordinary circumstance that with all the alien grafts of ideas and attitudes on the compilation, it somehow retains clear pointer to a very sound criterion for distinguishing what is intrinsic and what is extrinsic to rationalist medicine in it.

6. CRITERION FOR IDENTIFYING WHAT IS EXTRINSIC AND WHAT IS INTRINSIC TO RATIONALIST MEDICINE

To begin with, let us note the account of a medical colloquium in the *Caraka-samhita* (i.12.9f). In this, a certain Varyovida expounds an anthropomorphic view of Wind as the ultimate principle governing everything. But another medical authority, Marici, leaps to the attack : "Even if all these were true, what is the point in saying or knowing these in the medical discipline ? Whatever is said here must be said strictly in accordance with the requirements of medicine." Thus, in short, what interests the physician is medicine and medicine alone. Anything without strict relevance for medicine is to be rejected as irrelevant for medical science, irrespective of the question of its truth or otherwise from the non-medical standpoint. We have in this bold protest of Marici against Varyovida's metaphysics a glimpse of the criterion by which to judge what is intrinsic and what is extrinsic to medical science in our extant medical compilations. Lest this should be ignored as being based on a mere isolated statement of an individual doctor, we shall note here how his point is being variously reiterated in the *Caraka-samhita*.

One chapter of the *Caraka-samhita* (iii.8) which formulates the model of medical treatise, finds it necessary to go also into much detail of the methodology of medical discussion. In the course of this, it explains certain fallacies resulting from the violation of the norm of right discussion. Two of these are specially relevant for our present purpose. One is called *adhika* or redundance, a form of which is irrelevance. The other is a particular form of the fallacy of contradiction or *viruddha*. Both these fallacies are included in the final list of what is technically called *nigrahasthana* or "point of defeat" (iii.8.65). One committing any such fallacy forfeits one's right to medical discussion.

What, then, are the two fallacies ?

The fallacy of irrelevance (*adhika* in one form) is illustrated as follows : *yat va ayurvede bhasyamane barhaspatyam ausanasam anyat va yat kincit apratisambandhartham ucyate.* "Thus, for example, while discussing medical science, to quote the authority of Brhaspati, Usanas, or to cite anything which is not strictly relevant to the subject-matter of medicine" (iii.8.54). Usanas—like Brhaspati in this particular context—is supposed to be a renowned authority of political science and jurisprudence in ancient India. But though considered authoritative in their own fields, it is only by committing the fallacy of irrelevance that one can quote them in a medical discussion, for the simple reason that such a discussion is supposed to be restricted to medicine and medicine alone. A statement, even though authenticated by some otherwise exalted persons, is not to be allowed in medicine unless it has positive medical significance. Let Usanas and Brhaspati enjoy their authority in their own fields. Since, however, what they say is medically irrelevant, a doctor is not allowed to cite their authority in the medical discussion. Such a dictum can be formulated only by those who have strict fidelity to their own science.

The fallacy of contradiction or *viruddha*, as the *Caraka-samhita* wants us to understand it, has three forms, resulting from a statement contradicting any of the following: (1) the instance (*drstanta*) cited in favour of it, (2) the conclusion (*siddhanta*) which it intends to establish, and (3) the specific context (*samaya*) in which it is made: *viruddham nama drstanta-siddhanta-samayaih viruddham* (Ib.). Of these three, we are specially interested here in the last, viz. the fallacy of contradiction resulting from a statement going against its own context or *samaya*. The *Caraka-samhita* wants to be quite specific about it:

> Context, again, is threefold. These are: (1) the context of medical science, (2) the context of ritual sacrifice and (3) the context of the doctrine of liberation.
>
> Among these, the context of medical science. (A statement relevant for it, is:) 'Medical science depends on four factors (viz. the physician, substances used as drugs etc., nursing attendant and the patient).
>
> The context of ritual sacrifice. (A statement relevant for it is:) 'The sacrificial animal is to be slaughtered by the yajamana' (or one who gets the sacrifice performed).
>
> The context of the doctrine of liberation. (A statement relevant for it is:) '(One must practise) non-violence to all living beings.'
>
> A statement becomes contradictory when it is made in violation of its own specific context. (Ib.)

The examples are carefully chosen. It is essential for the sacrificial context to state that the sacrificer must slaughter the sacrificial animal. It is equally essential for the context of the doctrine of liberation to state that one must practise total non-violence. Thus the essential proposition of one context, if allowed to be mentioned in that of another, results in flat contradiction. However, the genuine physician is interested in neither of these two contexts. He is interested only in safeguarding the integrity of his science. For this purpose, he is formulating the general rule that in medical science no proposition is to be allowed which does not belong to the strictly medical context.

Still the way in which the fallacy of contradiction resulting from the confusion of contexts, as illustrated in the text, has its own interest. It is the way in which the physician is trying to defend the integrity of his science against the possible intrusion of it by counter-ideology. *No proposition belonging to the context of ritual or that of* moksa *is to be allowed in medicine.* But these two contexts of ritual and liberation represent the two branches of Vedic orthodoxy, generally called its *karma-kanda* and *jnana-kanda*. Sacrificial ritual is the be-all and end-all of the former, liberation that of the latter. To resist the invasion of medical science by Vedic orthodoxy, the physicians require the general rule of excluding the possible confusion of contexts. In substantiation of the rule, they remind the doctors of the two main branches of Vedic orthodoxy and of the fatal consequence of confusing these with medicine. Thus the way in which the physicians illustrate this amounts to the assertion that, for the sake of self-consistency, medical science has to avoid Vedic orthodoxy as a whole. Significantly, apart from the context of strict medical science, the text speaks only of two other contexts —the ritual-context and liberation-context, i.e. *karma-kanda* and *jnana-kanda*. Propositions belonging to either of these two is not to be allowed in medicine.

The physicians seem to reiterate the dictum, in the course of which they find it necessary also to come out with a defence of the essentially rationalist attitude. As it is put in the *Caraka-samhita* :

> In a colloquium (*vada*, meaning 'debate') of the physicians, they must move strictly within the limits of medical science and must not digress to anything else (*vadastu khalu bhisajam pravartamano pravarteta ayurveda*

eva, na anyatra). The propositions and counter-propositions on all the topics covered by it are to be clearly and cogently worked out. Every statement made must be based on a clear and careful understanding of these. Medical discussion is to allow no proposition which is irrelevant, unauthoritative, uninvestigated, without any practical significance (*asadhaka*), confused and without a general applicability (*avyapaka*). Every proposition must be substantiated by reason (*sarvam hetumat bruyat*). Only those propositions that are substantiated by reason and are untainted by any other consideration, prove useful for therapeutic purpose, because such propositions alone help the intellect to be broadened (*prasasta-buddhi-vardhakatvat*) and only uninhibited intellect (*anupahata-buddhi*) leads to the successful culmination of an undertaking. (iii.8.67)

Here then we have a definite criterion for determining what is intrinsic and what is extrinsic to rationalist medicine in the two grand compilations in their present form. Medical science is concerned with four and specifically four factors : the doctor, the substances used (as drug or diet), the nursing attendant and the patient. The qualifications essential for each are also specified. The discussion of something connected with these are intrinsic to medical science. By contrast, any topic unconnected with these —howsoever much may be their importance in philosophy, religion and traditional morality—are extrinsic to medicine. One has therefore to scrap all these for the purpose of forming an idea of the real theoretical fundamentals of rationalist medicine.

7. THE CHRONOLOGICAL QUESTION

With this clarification of the contents of the *Caraka-samhita*, we may now pass on to the question of its possible dating.

We have already seen why any hope to date the text by accepting an individual authority bearing the proper name Caraka is at best questionable. For the purpose of dating the formation of the essential doctrinal content of our compilation, we have to look elsewhere. It is perhaps to be found in the *Vinaya-pitaka* of the Buddhists which the Buddhists themselves "place at the head of the canon."[43] An entire section of it, called *bhesajjaka*, is devoted to the discussion of medicaments. The way in which this discussion is introduced is exteremely relevant. The Buddha is reported that certain monks of his order (*samgha*) have fallen sick, are advised by the doctor to take some substances as cura-

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43. M. Winternitz ii. 21.

tive agents and the Buddha is asked if the taking of such substances would be consistent with the codes of conduct of the monastic order. Except for human flesh, the Buddha allows everything though specifically for the medical purpose. The entire discussion is remarkable, specially when we note that the wide range of curative agents recommended are only natural substances which is strongly reminiscent of the essential point of *yukti-vyapasraya bhesaja* of the *Caraka-samhita*—i.e. therapy based on the use of natural substances as diet or drug rather than resorting to spells, charms, amulets, etc., the characteristic of *daiva-vyapasraya bhesaja*. The entire section of the *Vinaya-pitaka* is totally unaware of spells, amulets, etc.

It needs to be noted in this connection that the Buddha, having as he did scant respect for the Brahmanical law-makers, was not in the least influenced by their contempt for medicine. On the contrary, many passages in the early Buddhist literature shows his pronounced enthusiasm for medicine. Besides, there are extensive legends about his close friend Jivaka, the grand physician of Buddhist India the whole of which could hardly grow out of nothing.

We do not have the scope here to go into the detail of all these. The question of the Buddha and medical science seems to form the theme of a comprehensive research. There is already a view according to which the Buddha was profoundly influenced by the medical science while formulating the fundamentals of his own teachings. Such a possibility cannot be rejected outright.

What we have been discussing here is, however, a different point. It is the possible dating of the theoretical fundamentals of rationalist medicine. Early Buddhist sources indicate that this took place sometimes before the Buddha. Whatever may be the date of the codification of the early Buddhist canons, it would obviously be impermissible to question the basic fact that these do embody the Buddha's teachings. Thus, in short, the steps to rationalist medicine was presumably taken sometime before the Buddha.

APPENDIX VI

EPISTEMOLOGY IN THE *CARAKA-SAMHITA* AND THE *NYAYA-SUTRA*

MRINALKANTI GANGOPADHYAYA

1. *Preliminary Remarks*

The *Caraka-samhita* (CS) is divided into eight books, called *sthana*-s, which again are divided into a number of chapters (*adhyaya*), the number varying from eight to thirty. The epistemological categories are mainly discussed by the CS in the first half of the eighth chapter of the third book, called Vimanasthana. [The lists of categories as in the CS and the NS are given at the end of the *Appendix*.]

The discussion is brief, more or less in the style of a Sutra work. First a list just mentioning the names of the topics the knowledge of which is considered relevant is given. Next, following the order of this original list, each is defined in simple terms and an illustration is added. The small portion embodying the discussion of these categories is meant to be a short manual for a physician providing him easily and without sophistication with the rudiments of logic and epistemology.

But why is it necessary for a physician to have acquaintance with the rudiments of logic and epistemology? The CS remarks, while giving the general list of the epistemological categories, that these are the basic things or topics (*pada*) the knowledge of which is essential for understanding properly the course of a debate among physicians. In other words, these topics are to be studied because of their relevance in the context of debate.

In fact, the importance of debate or discussion with experts in the subject has been greatly emphasised by the CS. At the beginning of the eighth chapter of the Vimanasthana, it points out that it is not enough to study the science under a teacher only. 'Then, after thoroughly studying the whole science through his (teacher's) favour, he should endeavour, in a proper manner, again and again, to achieve a deeper understanding of the science, easier comprehension of the expressions, mastery over the subject-matter and the power of exposition'. But what are the means for achieving it ? The CS speaks of three and one of them is debate: studying, teaching and discussion with persons who are versed in the science (*tad-vidya-sambhasa*). Caraka has even been considered the first to put on record in his work the importance of debate 'as an aid to the positive enrichment of theoretical equipment'. S.N. Dasgupta categorically asserts : "We hear of debates, discussions or logical disputes in literature much earlier than the *Caraka-samhita* ; but nowhere was the acquirement of this art deemed so much a practical necessity . . . as among the medical men. And, since there is no mention of the development of this in any other literature, it is reasonable to suppose that the art of debate and its accessories developed from early times in the traditional medical schools, whence they are found collected in Caraka's work."

In the *Nyaya-sutra* of Gautama also a place of prominence has been assigned to debate. It has even been suggested that the Nyaya originated from the studies in the art and method of public debates, and internal evidences from the *Nyaya-sutra* have been cited to lend support to the hypothesis. The first *sutra* of the work which gives a list of sixteen special categories the knowledge of which is considered essential for the attainment of the highest good includes not only three distinct forms of debate but also a number of topics specially connected with debates. Accordingly, the second part of the first chapter and the whole of the fifth chapter discuss the nature of the different forms of debate and topics essentially connected with them. It has thus led some scholars to conclude that 'the categories (in Gautama's first *sutra*) represent stages in dialectic or in the process of clearing up knowledge by discussion'. Even if it may be difficult to be so categorical, there is no doubt about the vital role played by debate in the development of the Nyaya system. As a modern scholar of Indian philosophy remarks, while emphasising the excellence of the Nyaya methodology : "It is fairly obvious that the source of this methodology is to be traced to the ancient practice of theoretical debate of which we have glimpses as far back as the days of the Upanisads. Interestingly, an Upanisadic word for it is *vakovakya*, which means something akin to what the ancient Greeks call dialectic, i.e., the art of debate by questions and answers."

With these preliminaries, let us first try to see what Caraka and Gautama have to say about debates.

2. *On debate : Caraka-samhita*

The CS has treated 'debate' in some details. It has pointed out its usefulness, given its classification and explained how a debate is to be conducted. It has also discussed some allied topics, such as, the nature of the assembly (*parisat*) before which a debate takes place, and the like.

As regards the usefulness of a debate the CS says :

"A physician should debate with another physician.

"A debate with an expert in the subject (*tad-vidya-sambhasa*) produces knowledge, deeper understanding (*abhiyoga*) and ardour (*samharsa*). It also leads to expertness (or, clarity of understanding) and produces greater power of expression and illumines one's fame further.

"Indeed, one may experience doubts with regard to what one has already studied ; (but when one holds a debate) one's doubts with regard to things already studied are removed because of recapitulation (*punah-sravana*). Even if one does not experience any doubt with regard to things already studied, a debate leads to a firmer conviction (about the right conclusion). It may also bring to one's notice certain important matters which one has not noted earlier.

"Moreover, a teacher, being specially pleased with a student who shows greater application (to study) may, by and by, explain to him the deeper implications (of the science) which are held to be secrets (*guhya*); now, when two persons debate with each other, one of them, desirous of victory over the other, may describe some of them (i.e. the secret implications) indicating their essential points, because of rivalry (and as a result, the implications—ordinarily not available to the other—become known to the other also).

"This is why the learned speak very highly of a debate with experts in the subject."

The debates, according to the CS, are of two forms, a friendly debate (*sandhaya-sambhasa*) and a hostile debate (*vigrhya-sambhasa*).

As regards the rules and procedure of the former, the CS says:

"Now, a friendly debate is prescribed to be held with one who has general knowledge (*jnana*) as well as technical knowledge (*vijnana*), the power to explain and give reply to a question; who is not easily angered, whose mastery of the science is faultless (*anupaskrta*), who is not malicious, who can be logically con-convinced and who is also adept in logically convincing others, who is capable of enduring pain and trouble and who converses pleasantly.

"While holding a debate with such a person, one should talk in a relaxed manner (*visrabdha*) and also, should put a question in a relaxed manner, and to one who puts a question in a relaxed manner one should explain the things fully and clearly.

"(In such a debate) one need not be annoyed by the apprehension of defeat (*nigraha*). One should not get elated even if one defeats the other. One should not boast before others. Led by false notion (*moha*) one should not illogically stick to some particular view exclusively. One should not speak about what one is not acquainted with. One should convince another by means of proper ground for conviction.

"In all this, one must remain very careful."

Regarding the rules and procedure of a hostile debate, the CS says :

"Besides this kind of debate, one may also hold a discussion (*jalpet*) with anybody else (*itara*) by a hostile debate, if one finds that thereby one would acquire some benefit.

"Before getting into such a debate one should critically examine the other position (*jalpantara*, i.e. the opponent's view), the relative strength of the opponent and oneself and also, the special character of the assembly (*parisat*) (before which the debate is going to take place)......

"While critically examining the relative strength of the opponent and oneself, one should also critically examine the characteristics of a debater, which are either beneficial (*sreyaskara*) or harmful (*dosavat*).........

"The characteristics said to be beneficial include a proper study of the science, a thorough understanding of the science, power of retention, timely recollection and power of expression. On the other hand, those said to be harmful include irascibility, lack of clear knowledge, timidity, lack of retentive power and carelessness. One should make a comparative assessment of these qualities in relation to the opponent and one's own self, considering their degrees, greater or smaller."

The CS classifies the opponent into three classes, namely, superior (*pravara*), inferior (*pratyavara*) and equal (*sama*). It specially points out further that this superiority or inferiority is to be determined only with reference to the presence, in a greater or a smaller degree, of the qualifications of a debater given above, and it has nothing to do with the family, caste, creed, religion or any other extraneous characteristic of the opponent.

The CS has also given a classification of assemblies (*parisat*) before which a debate should take place. First, an assembly may be either learned (*jnanavati*) or ignorant (*mudha*). Cakrapani here comments that an ignorant assembly does not really mean an assembly of some illiterate or foolish persons, for in that case nothing would be achieved by holding a debate in its presence. The implication actually is that the persons concerned may be deficient in respect of some minor function or the like only.

These two kinds of assemblies may be subdivided into three further classes—friendly, indifferent and hostile.

Naturally enough, any debate in the presence of a hostile assembly—irrespective of whether it is learned or ignorant—is forbidden. But as regards a debate before the other kinds of assemblies the CS has rather vividly described how one should proceed about it. Thus, it is said :

"It is prescribed that before an ignorant assembly—if it be a friendly one or an indifferent one—one may start a debate, even though one may not have general knowledge or technical knowledge, power of expression and ability to give a reply, with a person who does not have much fame and is despised by the people.

"While disputing with such a person one should speak in stiff and lengthy sentences (*vakya-dandaka*), abounding in long *sutra*-s and crooked (*aviddha*) words. Showing much elation one should again and again laugh at the opponent, and speak, pointing at the assembly, by various gestures of the body (*akara*) and should give the opponent little opportunity to speak.

"Speaking in unintelligible words (*kasta-sabda*) one should say (to the opponent) 'you have failed to state your viewpoint' or 'your thesis is lost' (*hina*).

"Called upon to continue the debate even then, one should reply 'wait and study for a whole year ; you have not certainly attended to the teacher's instructions properly', or 'this much is enough for you ; an opponent defeated once is said to be defeated for good'···

"Before a friendly assembly, one may be engaged in a hostile debate with an inferior or a person whom one considers to be equal.

"Or, while debating before an indifferent assembly... one should carefully make note of the opponent's strength as regards the merits and the demerits, and after a careful examination, one should not be engaged in a debate on such a subject in which one considers him (opponent) to be superior, without revealing thus one's lack of acquaintance with the subject. However, one should be (immediately engaged in a debate) on a subject in which one considers the opponent inferior and should defeat him quickly."

The CS also gives some specific hints about how a particular type of opponent is to be tackled and humiliated. Thus it says :

"For example, one who is not in touch with the subject should be overpowered by longish quotations from the text ; one who is devoid of intelligence by sentences full of obscure words ; one who cannot retain sentences in memory by stiff and lengthy sentences, abounding in long *sutra*-s and crooked words ; one who cannot recollect timely by using the same words having various meanings ; one who is devoid of power of expression by forcible interruption when one has only half-completed one's statement ; one who has no clear understanding by making one look ashamed; the irascible by harassing unnecessarily (through words); the timid by making him extremely apprehensive ; and the careless by subjecting him to rules and regulations."

It speaks of some other tactics too, which a debater may adopt to make his position favourable :

"At the very outset, one should try to achieve this : becoming friendly with the assembly, one should make it select a topic for discussion (*prakarana*) which one has gone over again and again (*ayanabhuta*) or which would prove extremely difficult for the opponent. Or, one should bring the opponent's thesis very much in disfavour with the assembly.

"If however the assembly is (already) favourably disposed to one, one should say 'we are unable to say anything (as regards the topic etc.); this very assembly will set, adequately, according to the context and according to its wish, the topic (*vada*) and the rules for the debate (*vada-maryada*).' So saying one should remain silent."

Lastly, the CS speaks of two kinds of hostile debate, *jalpa* and *vitanda*.

Of these, *jalpa* is defined to be an argumentative dialogue between two contestants, when each argues by offering a thesis of his own and defending it ; e.g. when one contends 'there is rebirth' and another contends 'there is no rebirth' and both establish their own thesis showing grounds in favour and pointing to fallacies in the view of the opponent.

Vitanda is the opposite of *jalpa*. It consists in only pointing to fallacies in the view of the opponent, there being no establishment or defence of one's own thesis.

On debate : Nyaya

In Nyaya, the term for debate in general is *katha* (NS v. 2. 19, and 23 ; Vatsyayana on NS i.2.1), which is very close in meaning to *sambhasa*.

According to Gautama, there are three kinds of debate, *vada*, *jalpa* and *vitanda*. He has given their definitions in a separate section (NS i.2.1-3) known as *katha-prakarana*. Gautama has not offered any general definition of debate, and as such, the later Naiyayikas had to try to find some. Thus, according to Vacaspati Misra and Varadaraja, a debate consists in the statements and counter-statements on the part of more than one contestant relating to a central theme. Visvanatha (17th cent. A.D.) adds that these statements and counter-statements should moreover be in accordance with the principles of logic and should have for their end either the attainment of right knowledge or victory over the opponent.

In early Nyaya—in the writings of Gautama, Vatsyayana and others—we find little discussion as to the rules or conventions to be followed while conducting a debate, although the definitions of the three kinds of debate have been carefully formulated in Nyaya terms and discussed with much sophistication.

Gautama's definitions of *vada*, *jalpa* and *vitanda* are as follows:

(a) *Vada* is a form of debate in which the thesis and the anti-thesis are respectively held as his own tenet by each of the two contestants (viz. the proponent and the opponent); each establishes his own position and refutes that of the other with the help of *pramana* and *tarka* ; none speaks of any tenet that contradicts a proved doctrine of one's own system ; and both (argue by) employing all the five inference-components.

(b) *Jalpa* is a form of debate which is characterised by all the features previously mentioned (i.e. in the definition of *vada*) and where, moreover, each contestant may establish his own position and refute that of the other with the help of *chala*, *jati* and *nigrahasthana*.

(c) *Jalpa* is turned into *vitanda*, if the opponent does not care to establish his own thesis.

Of these three forms of debate, though *jalpa* and *vitanda* may in a rare case lead to the 'attainment of right knowledge' (*tattva-nirnaya*), their primary purpose is 'victory over an opponent' (*vijaya*). By contrast, *vada* has for its primary purpose only the attainment of right knowledge. *Vada* par excellence is a discussion between the preceptor and the disciple leading to truth alone. Thus, for example, in the case of *jalpa*, the debate would come to an end as soon as one of the contestants is declared defeated, although there may not be the positive ascertainment of any thesis. *Vada* however ends only when one of the positions contended is finally logically established. Althougs victory is stated to be the primary purpose of *jalpa* and *vitanda*, the ultimate aim to be achieved by them is the sustenance of true *vidya* (*vidya-paripalana*) or the protection of the ascertainment of truth. They should not be entered upon simply for the purposes of acquiring wealth, obtaining honour and earning fame. Thus, Gautama declares in a later section (iv.2.50): "*Jalpa* and *vitanda* are to be employed for protecting the ascertainment of truth, just as fences with thorny branches are constructed to protect the seedling coming out of the seed". (See also Vatsyayana on iv.2.50-51).

Chala, *jati* and *nigrahasthana* being mostly forms of unfair replies are not generally to be employed in a *vada* ; but in *jalpa* and *vitanda* they may be freely employed. *Vitanda* is differentiated from *jalpa* by the fact that in such a debate the opponent is not interested in substantiating any thesis of his own, but only criticises whatever is pur forward by the other party.

With regard to debate some points of general agreement between the views of Caraka and Gautama may be easily noted.

CS's *sandhaya-sambhasa* exactly corresponds to Gautama's *vada* and CS itself classifies *vigrhya-sambhasa* into *jalpa* and *vitanda*. That these two forms of debate involve hostility, even in Gautama's view, is clear from the fact that, according to him, the primary aim of these is victory over the opponent by any means. Naturally enough, the definitions in the CS are much simpler whereas those in Gautama are rather technical and sophisticated, although the basic similarity can hardly be overlooked.

In the case of a hostile debate, the CS speaks of adopting means for silencing an opponent which are not really very straight and fair. In a similar case, Gautama too recommends the employment of *jati* (futile rejoinder based on mere similarity or dissimilarity) etc. which are admittedly some kind of 'unfair replies' (*asad-uttara*).

The CS recommends debate among physicians for a better understanding of the science. Gautama too speaks of holding discussions with persons who have a thorough knowledge of the system for the purpose of bringing 'maturity to the knowledge acquired' (*prajna-paripaka*) and this maturity of knowledge means (according to Vatsyayana) dispelling doubts, understanding the intricate implications previously unknown and firmly reascertaining what is already ascertained, and in clarification, Gautama adds further, "One should go on to hold discussions with the disciple, the preceptor, the fellow-student and such other particular persons as are desirous of acquiring the final good—who are all without malice (i.e. hold critical discussions not for victory, but for the ascertainment of truth only)." (NS iv.2.47-48)

The rules and conventions regarding the proper conduct of a debate have been discussed by some later Nyaya-Vaisesika authorities. Specially, Udayana (984 A.D.) in his *Prabodha-siddhi* and Sankara Misra (*c.* 1425 A.D.) in his *Vadivinoda* have discussed all these in great details. Varadaraja (*c.* 1150 A.D.) also makes a note of these and Visvanatha (17th cent. A.D.) in his *Nyaya-sutra-vrtti* describes step by step how a *jalpa* should proceed.

Thus, for example, it is generally admitted that in a *jalpa* or or *vitanda* there are four vital components (*anga*), namely, (i) the proponent (*vadin*), (ii) the opponent (*prativadin*) (iii) the members of the council (*sadasya*) and (iv) the president of the council (*sabhapati*).

The king himself or somebody else of an equal status and power should act as the council-president. He should appoint fit persons as council-members and initiate a debate between the two contestants, each striving for victory.

The contestants should address all their views and arguments to the members. The members should carefully watch that everything proceeds according to rule, and finally, give the verdict as to which of the two is to be declared victorious. After ascertaining the verdict of the members, the president should make the declaration.

According to Varadaraja, the president should be a person accepted by the members as well as the two contestants alike, devoid of attachment (*raga*) etc. and one able to punish or reward. His duty consists in declaring the result of the debate and seeing that the thing agreed upon as the bet (*pana*) is duly given away to the victorious. He may also himself make a gift of umbrella etc. to honour the successful one.

The members, according to the same, should be persons acceptable to both the contestants, expert in understanding the implications of the doctrines (*siddhanta*), moved by neither attachment nor aversion, expert in keeping in memory and explaining what has been stated by others and uneven in number (so that in the case of a divided opinion, the opinion of the majority may be accepted as the decision).

According to the Buddhists and the Jainas, debate is of only one form, called *vada*, which however may be promoted by the desire for either victory or ascertainment of truth.

3. *Epistemological Categories*

After concluding its discussion on debates, the CS gives a long list of forty-four essential topics which it is going to discuss presently. In the very first *sutra* of his work, Gautama also gives us the names of the topics or categories which he considers relevant. But his list is shorter comprising of only sixteen topics.

In the list of the CS the topic mentioned first is *vada*. *Vada* here stands for a hostile debate comprising of two forms, *jalpa* and *vitanda*. We have already noted them above.

The six topics mentioned next—namely, substance, quality, action, universal, particularity and inherence—are the six well-known categories (*padartha*) of the Vaisesika system. The CS has discussed them in the first chapter of Sutrasthana and here it refers the reader to it. (We also propose to discuss them in a separate appendix.)

We have next thesis (*pratijna*), with which, both according to the CS and Gautama, the inferential process or argument starts. The CS defines it as the statement of what is sought to be proved (*sadhya*); for example, 'the self (*purusa*) is eternal'. This is in complete agreement with Gautama (NS i.2.33, *nirdesa* and *vacana* being synonymous). However, in Nyaya, *pratijna* is not a separate topic; it is an integral part and the first member of an 'inference-for-others' (*pararthanumana*) consisting of five specific statements arranged in a fixed order. Of the sixteen categories enumerated in NS i.1.1, it is included in the category of *avayava* or inference-components.

Establishment (*sthapana*) and counter-establishment (*pratisthapana*) are two topics essentially connected with debate; two indispensable steps for starting a debate. The former is defined to be the substantiation by one of a thesis with the help of a probans (*hetu*), a corroborative instance (*drstanta*), an application (*upanaya*) and conclusion (*nigamana*). The latter is defined to be the substantiation of a view opposed to one's own thesis but held as a thesis by the opponent. These are illustrated as follows. The proponent says: (thesis) the self is eternal; (probans) because it is not produced ; (instance) for example, *akasa* ; (application) just as *akasa* is not produced and is also eternal, so is the self ; (conclusion) therefore, it is eternal. To this, the opponent says : (thesis) the self is non-eternal ; (probans) because it is perceived by the sense ; (instance) for example, a jar ; (application) just as a jar is perceived by the sense and is also non-eternal, so is the self ; (conclusion) therefore, it is non-eternal.

Although *sthapana* and *pratisthapana* have not been given any separate or special status among the categories in the *Nyaya-sutra*, it appears that their relevance is not totally overlooked. Thus, in the definitions of *vada* and *jalpa*, Gautama refers to these two by the terms *sadhana* and *upalambha* and says that they are indispensable for both these forms of debate. (The synonyms for these two given by Vatsyayana are respectively *sthapana* and *pratisedha*. Their role in arriving at the truth is explained by Vatsyayana in his comments on the definition of *nirnaya* or final ascertainment, NS i.1.41).

According to the CS establishment and counter-establishment are to be made with the help of *hetu*, *drstanta* etc., but, according to Gautama, they are to be made with the help of *pramana* or instrument of valid knowledge and *tarka* or reductio (the latter being not itself a *pramana* but a valuable accessory to *pramana* ; NS i.1.40 and Vatsyayana's comment thereon).

The word *sthapana* (in the same sense) has been used by Gautama in the definition of *vitanda* (NS i.2.3).

According to some, counter-establishment here is the same as the fallacy of inference (*hetvabhasa*) called *sat-pratipaksa* or the counter-acted. The CS mentions a number of fallacies of inference, but there is no reference to the counter-acted there.

The two illustrations of establishment and counter-establishment given by the CS here are also good examples of what is known in Nyaya as *pararthanumana*, which consists of five statements (called *avayava*) to be given in a specified order, namely, *pratijna*, *hetu*, *udaharana*, *upanaya* and *nigamana* (NS i.1.32-39). CS's order is the same as the Nyaya order and the terms are also the same except in the case of the third, *drstanta* replacing *udaharana*, which does not make any material difference.

Hetu is defined by the CS as the instrument (*karana*) of cognition (*upalabdhi*). It is of four kinds, namely, perception (*pratyaksa*), inference (*anumana*), tradition (*aitihya*) and resemblance (*aupamya*). Finally, he adds, commenting on their special function 'that which is arrived at through these *hetu*-s is the truth (or the real nature of a thing, *tattva*)'. All this seems to make *hetu* synonymous with what is generally known as *pramana* (source of valid knowledge) in Indian philosophy. Perception and others are all recognised as *pramana* by the different systems, and the determination of truth or the real nature of a thing is unanimously accepted to be the function of *pramana*. According to Nyaya, *pramana* is the instrument of cognition and this general definition follows from the etymology of the word itself (*pramiyate anena iti pramanam* ; *prama-karanam pramanam*; cf. Vatsyayana on NS i.1.3 : *upalabdhi-sadhanani pramanani iti* etc.). Assuming that *aitihya* and *aupamya* here represent respectively what are generally known as *sabda* and *upamana*, we have here an enumeration of *pramana*-s which exactly agrees with the one accepted in Nyaya (NS i.1.3). (See also *infra*, under *aitihya* and *aupamya.*) Besides, they are accepted as *pramana* by other systems also.

But in the CS itself we have at least on two other occasions references to what are generally recognised as forms of *pramana* not only by Nyaya but also by other systems.

First, in Sutrasthana (xi.17), the CS says that there are four forms of *pariksa* or critical examination, namely, *aptopadesa*, *pratyaksa*, *anumana* and *yukti.* Cakrapani explains that the term *pariksa* here stands for the means for critical examination which reveals the true nature of objects and is thus synonymous with *pramana.* Of these four, the last one is not accepted to be a *pramana* by any system, but the other three are generally so accepted (the first obviously representing *sabda*).

Secondly, at the beginning of the fourth chapter of Vimanasthana (iv.3) we have an enumeration of the means for acquiring the special knowledge of diseases, which includes exactly the first three given in the list of Sutrasthana leaving out *yukti.* Here also Cakrapani refers to them as the three forms of *pramana.* It is specially recommended that a physician should take the help of these while determining the specific nature of a disease and if possible he should gradually apply all of them to the same case. He should first acquire the knowledge from *aptopadesa* and then subject it to examination through perception and inference. This is rather similar to what is called, in Nyaya, *pramana-samplava* or convergence of different *pramana*-s on the same object, though there perception is considered the ultimate and most decisive one (see Vatsyayana on NS i.1.3).

We have thus three different lists of *pramana*-s from the same text, one in Sutrasthana and two in Vimanasthana. Perception and inference only are common to all the lists, but their treatment is not always the same. The definitions of these two are exactly the same on both the occasions in Vimanasthana, but in Sutrasthana they are defined differently. The treatment of inference specially is quite different. The descriptions of an *apta* also, in Sutrasthana and in Vimanasthana, do not agree. Besides, all the four described as forms of *hetu* have also been included in the same list (in Vimanasthana) as separate topics. They have each been separately defined and illustrated (see *infra*), which does not agree with the procedure generally followed.

Cakrapani tries to show in his own way that these three enumerations, though different, do not involve any inconsistency. He says that in CS's view the *pramana*-s are only three, namely, perception, inference and verbal testimony. They are clearly mentioned in the list of Sutrasthana and the earlier one in Vimanasthana. How is it that the former includes *yukti* and the latter does not? Cakrapani explains that truly speaking *yukti* is not a *pramana*. It is a kind of mental deliberation or argumentation (*uha*) in the form 'it must be such and such'. But it is a valuable accessory to *pramana*, helping it vitally in the function of rightly determining the nature of an object (*pramana-sahaya*). People as they carry on their daily life depend much upon such deliberation for the ascertainment of objects and because of this importance it is referred to as a *pramana* without being actually so.

Cakrapani's comments about the nature of *yukti* make it almost identical with what is known as *tarka* in Nyaya. *Tarka* is included in the list of sixteen categories given by Gautama and in Nyaya, though not given the status of a separate *pramana*, its importance as an accessory to *pramana* (specially to inference) is recognised. It is not difficult to show that on quite a number of occasions Cakrapani—belonging as he does to roughly the eleventh century A.D.—has been much influenced by Nyaya-Vaisesika doctrines. It is possible that because of this influence he tries to show the consistency of the two enumerations by equating *yukti* of the CS with *tarka* of Nyaya. But he leaves unexplained why on these two occasions the *pramana*-s are defined and discussed rather from different standpoints.

Moreover, a Buddhist text on logic and philosophy, the *Tattvasamgraha* of Santaraksita and its commentary by Kamalasila, belonging roughly to the eighth century A.D., clearly state that, according to the CS, *yukti* is an independent form of *pramana*. As presenting the opponent's position, they also explain its nature, but finally reject it by claiming that *yukti* is really a kind of inference. It is not that Cakrapani is unaware of all this, for he quotes at length from both. But he finds their contention untenable and thinks that they have misunderstood the implications of the CS.

As to the passage on *hetu*, Cakrapani offers a quite different explanation. According to him, it is not an enumeration of *pramana*-s. The term *hetu* means here any *pramana* by which the *hetu* or probans of an inference may be ascertained. Immediately before, explaining establishment and counter-establishment, the CS has shown that they are of the nature of inferences. It thus mentions afterwards some *pramana*-s by which one may ascertain a probans. S.N. Dasgupta (*A History of Indian Philosophy*, vol. ii, p. 380) gives the illustrations. Let us take the following four instances: (a) the hill is fiery, because it smokes; (b) he is ill, because he is of low digestion; (c) the self is eternal, because it is uncreated; and (d) his face is most beautiful, because it has been compared with the moon. The probantia in them are ascertained respectively through (a) perception, (b) inference, (c) verbal (scriptural) testimony and (d) resemblance.

Dasgupta further remarks that although the definition of *hetu* in the *Nyaya-sutra* refers only to the perceived *hetu* in the case of inference, there is no conflict between the NS and the CS. The CS only says that a *hetu* may be discovered by any of the *pramana*-s, and by whichever one it may be discovered, it may be called a *hetu*, if it is invariably and unconditionally related to the inferable property.

But all this appears to be due to the interpretations of the later commentators. The point that the probans of an inference may be ascertained not only by perception but also by any other source of knowledge is first raised, among the Naiyayikas, by Uddyotakara (c. 6th cent. A.D.), Accordingly, he interprets Gautama's definition of inference in a novel way showing that such an implication is contained in Gautama's *sutra* itself. Cakrapani is well-acquainted with the Nyaya-Vaisesika doctrines and his interpretations are clearly influenced by them. But the point both the CS (cf. Sutra-sthana xi. 21) and Gautama (NS i. 1.5) seem to emphasise is that inference is vitally dependent upon perception. An inference can never proceed except on the basis of a previous perception or some direct experience. Even when a probans is said to be ascertained by some other *pramana* than perception, the ultimate basis must rest on some perceptual experience. One of the later philosophers to emphasise the supreme role of perception in inference is Kumarila Bhatta (c. 8th Cent. A.D.), the founder of the Bhatta school of Mimamsa (*Slokavartika*, chapter on inference, verse 170).

Further, even assuming that under *hetu* the CS is giving us an enumeration of *pramana*-s leading to the ascertainment of a probans, it remains unexplained how *aitihya* and *aupamya* find a place in it as they are not recognised as *pramana* by the CS anywhere else.

Next is defined corroborative instance (*drstanta*). A corroborative instance is that in regard to which the unintelligent (*murkha*) and the learned, have the same notions, a thing which illustrates beyond doubt a point sought to be established. For example, facts such as fire is hot, water is liquid, the earth is firm and so on. Or, in the inference of fire from smoke, such an instance is the kitchen (*mahanasa*). In the kitchen, anybody can verify the fact that smoke is accompained by fire, which is the basis of the inference.

Hhere the view of the CS is in complete agreement with that of Gautama (NS i.1.25 and Vatsyayana's commentary on it), who also admits it as a separate category. However, later commentators of Nyaya point out that since a debate can take place only between two experts, and not between an ordinary person and an expert, and since moreover the instance cited may be too technical to be understood by an ordinary person, the real implication here is that an instance should be such that it would be readily acceptable as illustrative of the point under discussion to both the proponent (*vadin*) and the opponent (*prativadin*) in a debate.

The next two topics, application and conclusion, are not defined as their nature can be easily understood from their illustrations given under establishment and counter-establishment. Here also, there is no difference between the CS and the Nyaya position. According to Nyaya, application is a statement showing that the probans as invariably related to the probandum is actually present in the subject (*paksa*). Conclusion is a re-statement of the thesis as one ultimately proved.

Rejoinder (*uttara*) is raising an objection, by pointing to dissimilarity when a probans is stated as based upon similarity and by pointing to similarity when a probans is stated as based upon dissimilarity. For example, one argues that an effect (*vikara*) is similar to its cause (*hetu*). Coldness is the cause of fever and in fever one has the feelings of cold, shivering etc. To this, someone else objects by saying that an effect is dissimilar to its cause.

Coldness is the cause of fever, but in fever one has a high temperature.

Rejoinder is in purport the same as what is called *jati* in Nyaya (NS i.2.18). It is one of the sixteen categories enumerated by Gautama and its treatment in the NS is elaborate (more than forty *sutra*-s being devoted to it). Gautama mentions and defines twentyfour forms of *jati*. Vatsyayana explains them elaborately with illustrations and also shows how one should get rid of a *jati* urged by an opponent. Caraka's reference is brief. He mentions only three forms of *jati*, and all of them are recognised by the NS too. But he gives them under a separate topic, as types of *ahetu* or pseudo-probans. (See *infra*)

Proved doctrine (*siddhanta*) is the final conclusion offered by experts after a thorough critical examination and establishing it by means of valid grounds. It is of four kinds. First, a doctrine unanimously held or admitted by all the systems (*sarvatantra-siddhanta*). For example, there are diseases and also remedies for the cure of the (curable) ones. Secondly, there may be a doctrine which is upheld by one system, but rejected by another (*pratitantra-siddhanta*). For example, some says that there are eight tastes (*rasa*), but others think that there are six tastes only. The doctrines of 'eight tastes' and 'six tastes' will be mutually *pratitantra-siddhanta*. Thirdly, there may be a doctrine or thesis which being established itself leads to the establishment of certain other theses also at the same time (*adhikarana-siddhanta*). For example, when it is established that a liberated person does not perform actions that bind to worldly existence, certain other conclusions too follow—that there are results of action, liberation, self and rebirth. Fourthly, there may be some view (put forward in the course of a debate) which is neither established, nor critically examined, nor advocated by any authority, nor based on valid ground ; but it is admitted only tentatively for carrying on the debate (*abhyupagama-siddhanta*). For example, one may say : 'even assuming that substance is the most primary, we argue' etc.

Proved doctrine is the sixth one in Gautama's list of categories. All the four forms stated above occur in the *Nyaya-sutra* with exactly the same names and the same definitions, though it is doubtful whether Gautama offers any general definition of it. In Nyaya, the third form is interpreted in two ways. First, it means the original conclusion which leads to the establishment of the other conclusion. Secondly, it means the other conclusion which is proved indirectly by the establishment of the original conclusion.

Sabda is verbal communication, communication through words (which are combinations of letters) expressive of meanings. It is of four kinds : (i) having a perceptible object (*drstartha*, according to Cakrapani, which indicates a thing whose existence may be proved by some other *pramana* also), (ii) having an imperceptible object (*adrstartha*), (iii) valid (*satya*) and (iv) invalid (*anrta*). The illustrations are respectively 'the humours of the body (*dosa*) are agitated due to three causes', 'there is rebirth', 'there are remedies for the cure of (curable) diseases' and 'there is no remedy for the cure of diseases'.

As we have already noted, earlier in Sutrasthana (xi.7) and Vimanasthana (iv.3-4), the CS mentions *aptopadesa* as one of the *pramana*-s, which is generally considered the same as *sabda*. Thus *sabda* as a *pramana* may be defined as the statement (*upadesa*) of a trustworthy person (*apta*). But who is a trustworthy person ? In Sutrasthana, the CS says : Trustworthy persons are those who have become completely free, by the power of penance and wisdom, from the influence of *rajas* and *tamas* ; their knowledge constantly reveals objects belonging to the three times (past, present and future), is ever-pure (i.e. valid) and ever-unobstructed (i.e. any kind of object may be known by them, even objects normally imperceptible). Such persons are variously called *apta* (trustworthy), *sista* (wise) and *vibuddha* (enlightened). Statements made by them are undoubtedly true. Indeed, since they are free from the influence of *rajas* and *tamas*, how would they speak what is not true ?'

Cakrapani comments that although this definition of *apta* applies only to persons having supernormal power, such as the sages and the seers, and not to any ordinary ones, it is to be understood that in ordinary cases *apta*-s would be persons who have the correct knowledge about the things they are speaking of and who while making the statements are not led by attachment and aversion.

On the other hand, the definition given in Vimanasthana (iv.4) is not only different but also makes an *apta* more mundane, general and credible. It also agrees in spirit with the description of *apta* as we find it in Nyaya. Thus an *apta* is a person who knows the thing he is speaking about with certainty, has direct experience of it and knows it in its entirety and he also judges a thing without attachment and aversion. The statement of a person with these qualifications cannot but be valid or reliable. But the statement of a person who is not so—who is intoxicated, insane, a fool or led by emotion—cannot obviously be so.

Gautama too has defined *sabda-pramana* in exactly similar words : *aptopadesah sabdha* (NS i.1.7). Thereon, defining the *apta* Vatsyayana says, 'The *apta* is a speaker (*upadestr*) who has acquired direct knowledge about the things (he is speaking of) and is guided by the desire of communicating the things (truly) as actually ascertained by him'. Then, he specially points out that this definition applies equally to all—the sages (*rsi*), the nobles (*arya*) and the barbarians (*mleccha*).

Of the four clases of *sabda* mentioned here, the first two are given in NS i.1.8.

In the CS we have already three references to perception (*pratyaksa*). Once in Sutrasthana (xi.17) as a form of *pramana*, and twice in Vimanasthana, first as a form of *pramana* (iv.3-4) and secondly, as a form of *hetu* (viii.33). Perception is accepted as the most important and primary source of valid knowledge by almost all the systems of Indian philosophy.

Though referred to differently, on both the occasions in Vimanasthana, the same definition of perception has been offered. Thus, 'perception is acquiring knowledge directly (*svayam*) through the mind (*atman=manas*) or the (external) senses'. Pleasure (*sukha*) and others are perceived through the mind, and sound (*sabda*) and the like are perceived through the external senses.

Commenting on the definition in Vimanasthana, Cakrapani first points out that the word *atman* (which ordinarily means the self) is to be taken here in the sense of the mind (*manas*), the internal sense. Otherwise the direct awareness of pleasure, pain and the like cannot be covered by the definition of perception. We have thus a reference to one of the generally accepted classifications of perception not only in Nyaya but also in Indian philosophy in general that perception is either external (*bahya*) or internal (*antara, manasa*). In fact, according to Nyaya, this very perception of pleasure and others is one of the inferential proofs for the existence of the mind as a distinct sense-organ, since such perception cannot be due to any of the accepted external sense-organs.

Cakrapani points out further that the word *svayam* in the definition, which is equivalent to *saksat* (direct, immediate), serves a special purpose. Sometimes an inferential cognition may take place while the sense-organ is still operative. The inclusion of the word *svayam* would exclude such a cognition from the scope of perception, for while perception is immediate knowledge, inference is mediated knowledge being acquired through some distinct successive stages. In other words, according to Cakrapani, in the view of the CS, immediacy (*saksattva*) is an essential mark of perception. There is no doubt that in Indian philosophy there is an extensive tradition particularly emphasising this trait of perception and defining it on its basis (see, for example, Gangesa's discussion on the definition of perception in the *Tattvacintamani*). May be the CS is one of the earliest to go by this tradition.

In Sutrasthana (xi.20), perception is defined as 'a cognition which is distinct (*vyakta*) and is immediately (*tadatve*) produced after the contact of the self, the sense, the mind and the object.' Cakrapani shows the justification for the inclusion of the various terms in the definition. The term 'distinct' excludes, from the class of perception, knowledge in the form of doubt (*samsaya*) and illusion (*vyabhicarini*). A doubt is indistinct as it cannot decide upon any one of the various opposed alternatives. An illusion is indistinct as it fails to reveal correctly the nature of the object. Again, an inferential knowledge produced just after a perceptual knowledge or a memory-knowledge too may be due, indirectly (*paramparaya*), to the contact of the four. Hence, to exclude them from perception, the term 'immediately' has been added. Perception is immediate knowledge, but the others are mediated knowledge.

Carkapani comments further that the contact of the four is actually mentioned here to indicate the causes of perception, and it is not intended to constitute a definition of preception. Actually, the definition implied here is only this much : '(knowledge) which follows from sense-object contact'. In fact, in the case of the perception of pleasure and the like contact of the four is not possible and such cases would not then be covered by the definition. Moreover, the contact with self cannot go into the definition of perception because it is a common cause for all kinds of knowldege.

Cakrapani also gives a list of six specific sense-object contacts: (i) conjunction (*samyoga*), (ii) inherence (*samavaya*), (iii) inherence in the conjoined (*samyukta-samavaya*), (iv) inherence in what is inhering in the conjoined (*samyukta-śamaveta-samavaya*), (v) inherence in the inhering (*samaveta-samavaya*) and (vi) qualificand-qualifier relation (*visesya-visesana-bhava*).

It is easy to see that Cakrapani is obsessed with the Nyaya tradition and explains the definition of the CS in such a way that it may be in total agreement with the one current in Nyaya. In the Nyaya definition of perception (first formulated by Gautama and subsequently accepted by one and all), emphasis is put on the contact between the sense and its appropriate object and it alone is included in the definition (NS i.1.4). But there is clear evidence to show that this way of defining perception does not go unchallenged. In the first chapter of the NS, under the *sutra* defining perception, Vatsyayana first of all notes the objection that the definition is defective since it does not include the other necessary contacts and he replies to it by emphasising the primary role of sense-object contact in perception. Gautama also, while critically examining perception in the second chapter (NS ii.1.21-30), discusses the objection in details.

Secondly, the list of sense-object contacts given by Cakrapani is simply a repetition of the Nyaya enumeration without any acknowledgement. Among the Naiyayikas, Uddyotakara (*c*. 6th cent. A.D.) is the first to classify sense-object contact, the special cause of perception, into six kinds, depending on the nature of the object cognised. Since then, this classification has been accepted, once for all, by the Naiyayikas and is repeated in all later works in the context of perception.

Another point Cakrapani draws our attention to, while commenting on this definition of perception, is also indicative of his obsession with Nyaya interpretations. The term *pratyaksa* may mean either perceptual knowledge (*pratyaksa-buddhi*) or the instrument of perceptual knowledge (*pratyaksa-pramana*). The former stands for the result and the latter for the means. The definition given here is of the former, but the context demands that it should be of the latter. The difficulty is to be avoided by adding an implied expression 'that from which (such knowledge arises)' (*yatah*). Then the reference would be to the means and not to the result. In Nyaya also, we find the same objection and the same answer.

In spite of all these comments of Cakrapani, it is however possible to offer another explanation. While treating perception on the two different occasions, in Sutrasthana and in Vimanasthana, the CS most probably follows two different traditions. In the early stage, the Vaisesika and the Nyaya were separate systems and had their own traditions in many respects. Thus, in perception, while the Nyaya advocates the supremacy of the sense-object contact, the Vaisesika is inclined to accord equal status to all the contacts. The earliest work of the Vaisesika is the *Vaisesika-sutra* (c. 1st cent. A.D.), attributed to Kanada. Because of various difficulties it is not always possible to form a definite conclusion on the basis of the VS. But there is at least one *sutra* (v.2.15) in the work which expressly mentions the contact of the four and may be construed as referring to the production of (perceptual) knowledge. The similarity of expression also between the VS and the CS may be noted. The former gives the compounded form *atmendriya-manortha-sannikarsat*, while the latter gives the uncompounded *atmendriya-manorthanam sannikarsat*.

The earliest systematic work of the system is the *Padartha-dharmasangraha* of Prasastapada (c. 5th cent. A.D.). It is more explicit and definite. While explaining the production of perceptual knowledge as in the case of the different categories, he does so by mentioning the total number of contacts necessary, without singling out any one. For instance, for the perception of a substance (*dravya*), contacts among the four are necessary, for that of sound (*sabda*, a quality or *guna*), it is the contacts among the the three and so on.

Besides, (as we have discussed in a separate appendix) the six basic categories of the Vaisesika have been referred to by the CS in the earlier part of Sutrasthana.

In short, it is not unlikely that while discussing perception the CS is following different traditions in different places.

Like perception, inference too is mentioned and discussed by the CS in a number of places. We have references to it in Sutrasthana (xi. 17. 21-22) as a form of *pariksa* or *prama* and also, in Vimanasthana, as a form of *pramana* (iv. 3-4), as a form of *hetu* (viii. 33) and as an independent topic (viii. 40). In the latter, we have just a definition and a few illustrations. But in the former, we have a definition, classification and illustrations, and a special characteristic of inference is also noted. In fact, as we shall presently see, the treatment there is quite different.

On both the occasions in Vimanasthana, the definition of inference is the same : 'It is a form of argument (*tarka*) based on reasoning' (*yuktyapeksa*). A long list of illustrations mentioning no less than thirty cases of typical inferences is given along with the earlier reference (iv.8). It is pointed out that inference is the best tool in the hand of a physician for diagnosing a disease and it is also shown how he should proceed to examine the patient and form his conclusions on the basis of inference. Thus, for example, he should infer digestive fire (*agni*) from the capacity to digest, physical strength from the ability to exert, the receptivity of the senses from their perception of respective objects, and so on. The one peculiarity about all these instances is that they are all inferences of the cause from the effect.

But this definition of inference, simple as it may appear to be, presents us with a problem. It does not agree with any of the definitions of inference traditionally offered in Indian philosophy by the various systems. Nor does it help in bringing out the nature of inference by pointing to any of its generally accepted essential characteristics. Inference is here identified with *tarka*, which is rather peculiar. It is not that the word *tarka* is never found to be used in the sense of inference. But it is not surely the usual practice followed by texts on logic and epistemology. *Tarka* is not an unknown concept in Indian philosophy. Gautama includes it in his list of sixteen essential categories (NS i.1.1). Its importance as an aid to knowledge is also generally recognised. Vatsyayana has explained how a correct conclusion can be reached by employing *tarka*. Though it is not given the status of an independent *pramana*, it is considered a valuable accessory to *pramana*. Specially, in the case of inference, it is considered almost an indispensable aid. Moreover, the definition says that inference is dependent upon *yukti*. But what is meant by *yukti* here ? As we have already noted, in Sutrasthana, *yukti* is used in a technical sense and it is counted as a *pramana* as distinct from inference. Should we take *yukti* here also in this special sense or in the ordinary sense of 'argument' or 'reasoning' ? But either way the definition remains confusing and it becomes difficult to say what kind of tradition the CS is following in the present context.

Cakrapani however, as he is wont to do, explains the definition in his own way and makes it conform to a standard definition of inference as offered in Indian philosophy. According to him, *tarka* here stands for knowledge other than perceptual or an indirect experience, and *yukti* means a relation, specially, in this context, the invariable relation between the probans and the probandum of an inference (generally called *vyapti*). Thus what the definition states is that inference is a form of indirect experience that arises on the basis of such an invariable relation. But Cakrapani does not explain how such a special meaning can be assigned to *tarka*. The word *yukti* may stand for a relation, but there is no specific reason for accepting it only in that particular sense. Besides, while explaining the nature of *yukti* in Sutrasthana, Cakrapani clearly identifies it with *tarka* as accepted in Nyaya.

On the other hand, in Sutrasthana, it is not only that the CS follows a different tradition, but it is also possible to identify this tradition with greater certainty. There two verses are devoted to the treatment of inference : '(Inference is knowledge) preceded by perception (*pratyaksapurva*); it is of three kinds ; and by inference can be known objects related to the three times (past, present and future). Thus, unperceived fire (=a present object) is inferred from smoke. Similarly, the learned ascertain past cohabitation from the observation of pregnancy. In the same way, the learned ascertain a future fruit from a seed observing directly that a fruit is invariably produced from a seed'.

This definition of the CS that inference is knowledge preceded by perception agrees word for word with the one given by Guatama. After defining perception (*pratyaksa*) in the immediately perceding *sutra* (NS i.1.4), Gautama gives the definition and classification of inference in the next (NS i.1.5): *atha tat-purvakam trividham anumanam purvavac chesavat samanyatodrastam ca.* Here the expression *tat-purvakam* gives the definition and the rest the classification. *Tat-purvaka* literally means 'preceded by it' and 'it' stands for perception defined in the 'preceding *sutra*. Thus *tat-purvaka* becomes equivalent to *pratyaksapurvaka* and the term used by the CS also is the same.

Explaining the definition Cakrapani first of all points out that the word 'perception' in the expression 'preceded by perception' is to be taken in a wider sense to mean any *pramana* which may lead to the ascertainment of the invariable concomitance (*vyapti-grahaka-pramana*). Hence, 'perceded by perception' should mean 'preceded by any such *pramana*' and it may be, besides perception, inference or verbal testimony even (see also *supra*).

The word *anumana*, Cakrapani further points out, may be literally construed as 'that by which (*yena*) is ascertained (*miyate*) afterwards (*anu*)'; that is, *anumana* means an instrument of cognition by which a non-perceptible (*paroksa*) object is rightly known subsequent to the ascertainment of invariable concomitance. Thus, specifically, *anumana* as a *pramana* stands for the perception of the probans as accompanied by the recollection of invariable concomitance. This seems to agree exactly with Vatsyayana's comments, who concluding his interpretation of the expression *tat-purvaka* remarks : 'Through the recollection (*smrtya*) and the perception of the probans (*lingadarsanena*) is inferred the object which is not perceived (*apratyaksa*=*paroksa*) at the moment'.

Both the CS and the NS state that inference is of three forms. The CS gives us three illustrations of inference, but does not give specific names for the three forms. Perhaps the three forms are intended to represent the inference of the three types of objects, namely, past, present and future (for each of which an illustration is given) and no other principle of classification is involved. The NS, on the other hand, simply gives three names for three forms. There is neither any illustration nor any hint as to their actual nature.

Vatsyayana, the author of the earliest extant commentary on the NS, explains and illustrates each of the three forms of inference referred to by Gautama in two different ways, which probably indicates early controversies regarding the interpretation of the three forms.

According to the first explanation, *purvavat* is the inference of the effect from the cause, e.g. inference of future rain from the rising cloud. *Sesavat* is the inference of the cause from the effect, e.g. inference of past rain from the fullness of the river. *Samanyatodrsta* is an inference based on general correlation, e.g. the inference that the sun has movement (after observing that the sun is at different places at different hours of the day), though it is imperceptible. It is based on the general observation that change of position means movement.

In the second explanation, *purvavat* means 'as previously'. Two objects (e.g. smoke and fire) are observed to be invariably related (as in the kitchen, the cowshed and so many other places). Later on, an object similar to one of them (e.g. some smoke) is perceived elsewhere (e.g. in the mountain), and this leads to the inference of an object similar to the other of them (e.g. some fire) in the same place. It will be a *purvavat* inference. The word *sesa* means the residue. Thus *sesavat* is an inference which proceeds by way of eliminating the other probable alternatives and rests as a result on the remaining one only. Thus, according to the Nyaya-Vaisesika, sound (*sabda*) is inferred to be a quality (*guna*) since all the other alternatives assigning it to other categories do not stand logically. *Samanyatodrsta* (lit. observed as having similarity) is an inference in which the invariable relation between the probans and the probandum being imperceptible, the probandum is known from a probans having general similarity. Thus the self (*atman*) is inferred as a substratum of the quality of desire (*iccha*). The invariable relation here cannot be directly known as the self is imperceptible. But since 'desire' is a quality and must share the common property of all qualities, namely, residence in some substance, it is inferred that the self is the substance in which 'desire' inheres.

According to Cakrapani, the three forms of inference referred to by the CS are : inference of cause from effect (e.g. co-habitation from pregnancy), inference of effect from cause (e.g. fruit from seed) and inference based upon, not causality, but a general concomitance between two objects (e.g. fire from smoke). In other words, the account of the CS is shown to agree with the tradition which upholds the first explanation of the three forms of inference given above, though, strictly speaking, according to it, the inference of fire from smoke will be an inference of the cause from the effect.

While illustrating the inference of the effect from the cause (fruit from seed), the CS adds 'observing directly that a fruit is invariably produced from a seed'. The purpose of this addition, according to Cakrapani, is to indicate that there is, definitely, invariable concomitance, through causality, between the seed and the fruit. Strictly speaking, the cause cannot be a probans for the effect, for there is no invariable concomitance between the cause as such and the effect. The presence of the seed is not necessarily accompanied by the presence of the fruit. Thus the real implication is that a seed as accompanied by the 'other co-operating causes' (*sahakari-karanantara*), such as air, water and light, is invariably connected with the effect. The connection between a cause and its effect may be irregular, but that between the 'collocation of causes' (*karana-samagri*) and the effect is an invariable one. These comments of Cakrapani perhaps indicate his awareness of the fact that, in Indian philosophy, though all logicians are agreed that an effect is a proper probans for inferring the cause, they differ as to whether a cause is a proper probans for inferring the effect. Buddhist logicians, particularly Dharmakirti, nowhere concede the possibility of the latter, but the Nyaya-Vaisesikas strongly advocate the same.

Besides referring to the threefoldness of inference, the CS also mentions a special feature of inference, that inference can grasp objects belonging to the three times. This especially distinguishes inference from perception which, as it is generally accepted, can grasp objects present only, objects past and future being beyond its scope. The fact is also substantiated by the three illustrations given. In Nyaya literature, we find that Vastyayana explicitly notes this speciality of inference. Concluding his explanation of the *sutra* on inference (NS i.1.5.), he says : 'Perception has for its object things present (*sat*). Inference has for its object things both present and absent (*asat*). Why ? Because of its capacity for grasping objects belonging to the three times. By inference are known objects belonging to the three times. We infer : it *will* be, it *is* and it *was*. By absent here are meant things past (*atita*) and future (*anagata*)'.

In the long list of topics in Vimanasthana, inference is followed by tradition (*aitihya*). It is defined as the communication (*upadesa*) of the trustworthy person (*apta*); for example, the Veda and others. The CS here equates *aitihya* on the one hand with *aptopadesa* and on the other with the Veda. But, as we have already noted, elsewhere the CS refers to *aptopadesa* as a form of *pramana*. The Nyaya and Vaisesika agree that it is a kind of *aptopadesa*, though they do not attach much importance to it. Thus Prasastapada remarks, '*aitihya*, when it is valid, is nothing but the communication of a trustworthy person.' According to the Vaisesika, *sabda* is not a distinct *pramana ;* it is a kind of inference only. Hence, tradition too would be nothing but inference.

Gautama too includes *aitihya* in *sabda* (NS ii.2.2), though he considers it a distinct form of *pramana.* Vatsyayana defines it as "an assertion (*pravada*) current for a long time in the form 'they say like this' (*iti ha ucuh*), but its original speaker is untraceable".

Cakrapani comments that the definition of *aitihya* given here is to be understood as the instruction from trustworthy persons who are *extraordinary* (*alaukika*) as distinguished from the instruction from trustworthy persons who are *ordinary* (*laukika*) and accordingly, it may be identified with the Veda.

Analogy (*aupamya*) has already been mentioned as a form of *hetu.* It is an ascertainment regarding the nature of an object by pointing to its similarity with another object. For example, the disease *dandaka* is described with reference to similarity with a *danda* (stick). Similarly, a physician adept in curing diseases is compared to an expert archer.

The brief and simple remarks of the CS seem to indicate that analogy is only a kind of description based upon similarity. But Cakrapani considers it to be identical with *upamana* which is admitted as a distinct form of *pramana* as based upon similarity by the Nyaya and the Mimamsa, though there is difference of opinion between the two as regards the nature and function of it. As the Nyaya would illustrate it, a villager who does not know what is a *gavaya* hears from a forester that a *gavaya* resembles a cow. Later he comes across a *gavaya* somewhere, perceives the animal's similarity to a cow, recollects the words of the forester and finally ascertains that the animal before him is called by the name *gavaya.* Thus the special function of *upamana* is to lead to the determination of the expresser-expressible (*vacya-vacaka-bhava*) relation between a word and an object. But an illustration showing the operation of *upamana* according to the Mimamsa, would be as follows. A man who has seen his own cow at home goes to the forest and on seeing a *gavaya* ascertains 'this *gavaya* is similar to my cow'. This ascertainment leads him to another ascertainment 'my cow is similar to this *gavaya*'. The first is a knowledge of the *cow's similarity* as present in the *gavaya*, while the second is a knowledge of the *gavaya's similarity* as present in the cow.

Cakrapani takes great pains to show that the definition of *aupamya* given here may be explained to agree with either view of *upamana*.

The definition of doubt (*samsaya*) given by the CS is not clear. According to it, doubt means non-acsertainment (*aniscaya*) of the nature of objects regarding which there is uncertainty due to the presence of causes for uncertainty. For example, it is observed that some persons have signs indicative of long life and there are some who do not have them. It is also observed that persons receiving medical care and persons not receiving it may die sooner and may live a long life. From all this, there arises a doubt : 'Is or is not premature death there ?'

Doubt comes third in the list of essential categories given by Gautama. In Nyaya, it occupies a position of much importance, particularly in its methodology. It is recognised to be the first precondition for any critical examination, which ultimately leads to final ascertainment (*nirnaya*). Doubt is in fact the starting point for philosophy. It has been treated in great details by Gautama and Vatsyayana (NS i.1.23 and ii.1.1-7).

According to Gautama, a doubt is an apprehension of contradictory properties (*vimarsa*) as relating to the same object at the same time. It is of five forms as depending upon five causes. It may be due to (i) apprehension of common characteristic, (ii) apprehension of unique characteristic, (iii) contradictory assertions, (iv) irregularity of apprehension and (v) irregularity of non-apprehension. Of these, the first and the third comprise the most general and numerous cases of doubt. Thus, in the insufficient light of the evening, one may see something standing still at a distance, and on perceiving in it the common characteristics of both a man and a post (e.g. a certain height, breadth etc.) may have a doubt 'Is it a man or a post ?' Again, one hears from somebody that there is a soul and from someone else that there is no soul, and one may have a doubt 'Is the soul existent or non-existent ?'

According to Kanada (VS ii.2.17) doubt is of one form only, being always due to the apprehension of common characteristic, which is Gautama's first form of doubt. The illustration of the CS also seems to correspond to it.

Doubt is followed by incentive (*prayojana*). Incentive is that for the sake of which efforts are made. This, for instance, one may think : 'If really there is premature death, then, I shall take care of myself with what contributes to longevity (*ayusya*) and avoid what does not do so. How would then premature death overcome me ?' The incentive here is the prevention of premature death.

Incentive is the fourth one in the list of sixteen Nyaya categories. Though verbally different, Gautama's definition of it is in essence the same (NS i.1.24). It is recognised to be one of the pre-requisites (*purvanga*) of *nyaya* (as well as for any kind of activity), for no critical examination can proceed without it. It may be either primary (*mukhya*) or secondary (*gauna*). When one strives after something for its own sake it is a primary incentive, namely, attainment of pleasure or cessation of suffering. A secondary incentive is one for which one strives not for its own sake, but because ultimately it would be a means for either attainment of pleasure or avoidance of suffering.

The CS differs from the NS in treating the irregular (*savyabhicara*) as an independent topic. It is defined, following the literal meaning, as what is attended with deviation (*vyabhicara*). For example, when it is said 'this medicine may be or may not be a remedy for this disease', which implies that the relation between the medicine and the cure is deviating or irregular. But, according to the Nyaya, the irregular is not a separate topic. It comes under the category of fallacious reason or *hetvabhasa*, representing the first one of its five forms. It is also known as *anaikantika* and means a probans which co-exists with the probandum as well as the absence of the probandum. For the inference of smoke fire is an irregular probans, because it co-exists with smoke in the kitchen and again, with the absence of smoke in the red-hot iron-ball. In Nyaya, the irregular is strictly connected with inference. The CS however gives no specific indication to that effect and the illustration is only a statement recording a deviation. Cakrapani comments that it would be wrong to identify (on the basis of the illustration) the irregular with doubt, for it is the cause of doubt and not doubt itself. Vatsyayana too argues that the irregular is really a cause of doubt concerning the presence or absence of the probandum in the subject and it is this peculiarity that differentiates it from another form of fallacious reason, the counteracted (*prakaranasama*).

For a definition of enquiry (*jijnasa*) the CS gives only a single word, namely, *pariksa* or critical examination. As Vatsyayana points out, critical examination is one of the essential steps in Nyaya methodology. First a category is simply named (*uddesa*), then it is properly defined (*laksana*) and lastly, it is critically examined (*pariksa*). Though the NS has nothing to do with enquiry, Vatsyayana makes a reference to it while explaining (NS i.1.32) the inference-components (*avayava*). He notes that 'some Naiyayikas' consider *jijnasa* to be one among the inference-components. Naturally, defending the position of Gautama, he refutes the contention. Yet he briefly explains its nature : 'Enquiry is that which provokes the desire for definite knowledge of an object only generally known. Why should one enquire about an object only generally known ? Because, after ascertaining the true nature of an object specifically, one resolves that one will either avoid or accept or be indifferent to it. The result of ascertaining the true nature of the object is either a knowledge producing aversion (*hana-buddhi*) or a knowledge producing attraction (*upadana-buddhi*) or a knowledge producing indifference (*upeksa-buddhi*). One is led to enquiry for the sake of of such a knowledge.' It is not clear if the CS is following such a tradition or not.

Ascertainment (*vyavasaya*) too is treated very briefly. It means arriving at a definite conclusion (*niscaya*); for example 'this disease is certainly due to *vata*', 'this is surely the medicine for it' and so on. Ascertainment seems to be the same as *nirnaya* or final conclusion, the ninth among the sixteen categories of Gautama. The definition given by him is not only explicit but also remarkable, emphasising that a definite philosophical position may be arrived at only after the consideration of the thesis (*paksa*) and the counter-thesis (*pratipaksa*): 'Final conclusion is the determination of the nature of an object by posing the thesis and the counter-thesis after having a doubt.' Indicating its relevance, Vatsyayana remarks : Final conclusion is the true knowledge of the nature of an object (*tattvajnana*). It is the ultimate result reached through the operation of the *pramana-s*. The *vada* form of debate terminates with it. The other two forms of debate, *jalpa* and *vitanda* are intended to protect it (from the refutation of the opponents).

Implication (*arthaprapti*) is really the same as the wellknown *arthapatti,* admitted as a separate *pramana* by the Mimamsakas. The CS mentions it as a separate topic, but nowhere includes it in the lists of *pramana*-s. According to it, 'mplication' occurs when an implication (*artha*), though not expressed in words, becomes established or conveyed on the basis of an implication already expressed in words. For example, when it is said 'the patient should not eat during the day', it follows 'the patient should eat at night.' Prohibition of eating by day is the expressed meaning and prescription of eating at night is the implied meaning.

According to the Mimamsakas, 'when a known fact cannot be accounted for without another fact, we have to assume or postulate the existence of that other fact. This process, in which knowledge of the fact to be explained leads to the knowledge of the fact that explains it, is called *arthapatti.* The etymological meaning of the word *arthapatti* is the assumption, supposition, or postulation of a fact (*artha*=fact, *apatti*=*kalpana*=supposition)'. The example generally given is also similar : 'A person who is known to fast by day is still quite stout. This stoutness cannot be accounted for unless we suppose that he eats at night'.

Gautama mentions it by name only, without giving any definition, but considers it a kind of inference and not an independent form of *pramana* (NS ii.2.1). Vatsyayana's definition of it is very similar to that of the CS. Cakrapani, with his usual bias for Nyaya interpretations, comments that, according to the CS also it is really a case of inference and accordingly it is nowhere mentioned in the lists of *pramana*-s.

It is difficult to understand why origin (*sambhava*) has been included in the list of topics here. It is defined (following its derivative meaning) as that from which a thing is produced. For example, the origin of impregnation (*garbha*) is the six *dhatu*-s ; of diseases unwholesome habits ; of health wholesome habits.

In philosophical literature, *sambhava* is said to be recognised as a distinct *pramana* by the Pauranikas, though all the major systems unanimously reject the claim. Gautama includes it in inference (NS ii.2.1-2). Vatsyayana gives its definition as follows : *sambhava* is the knowledge of the existence of something derived from the knowledge of something else which is not possible without it (i.e. the former). For example, from the knowledge of a *thousand* is derived the knowledge of a *hundred* ; if a man has one thousand rupees, it follows that he has already one hundred rupees.

Rather strenuously, Cakrapani tries to argue that in defining *sambhava* here the CS follows the Samkhya view of causation, *satkarya-vada,* the doctrine that the effect is contained in the cause and accordingly, *sambhava* as a *pramana* also is covered by the definition. But the CS does not include it in any of the lists of *pramana*-s.

Next is *anuyojya.* The term *anuyojya* may mean, in a derogatory sense, what is fit to be ensured, or, in a general sense, that about which questions may be put (say, for clarification). The two definitions of it given here by the CS seem to be based upon these two meanings of the word. Thus, it is first defined as an assertion which is marked by the flaws of a statement (*vakyadosa*) (see *infra*). Secondly, it is defined as a statement employed to ascertain a specific point when some idea has been expressed in a general way. Here an example too has been added. When it is said 'this disease is to be cured by *samsodhana* (purification)', a further question may be put 'is it then curable by *vamana* (vomitting) or by *virecana* (purgation)?'

Gautama does not mention *anuyojya* as a separate topic. But we have in the NS the two terms *pary-anuyojya* and *nir-anuyojya* in the definitions of the nineteenth and the twentieth points of defeat (*nigrahasthana*). From this, the meaning of the term *anuyojya* appears to be 'one who is liable to be censured' for committing a point of defeat.

According to the CS, the non-censurable (*ananuyojya*) too is a separate topic. It is defined to be just the opposite of the censurable. For example, a statement which needs no further clarification, e.g. 'this disease is incurable'.

We have also nothing in the list of Gautama to correspond to the next two topics, namely, query (*anuyoga*) and re-query (*party-anuyoga*). A query is a question or the part of a question concerning the whole system or any particular part of it, put by experts in the system in course of a discussion with other experts in the same system for the purpose of testing the knowledge, intelligence, power of expression and ability to give a reply. Thus, when one puts forward the thesis 'the self is eternal', another asks 'what is the ground?' Re-query is a further query about the initial query, when, as in the above case, it is asked 'what again is the ground for such a query?'

The CS treats, somewhat elaborately, the flaw of a statement (*vakyadosa*), which prevents the understanding of the intended meaning of a sentence, dividing it into five forms. They are deficient (*nyuna*), redundant (*adhika*), meaningless (*anarthaka*), unconstrued (*aparthaka*) and contradictory (*viruddha*). All the five are mentioned by the NS, though not as included in a separate category called the flaw of a statement. The first four are forms of the category known as point of defeat and the last is included in the category of pseudo-probans (*hetvabhasa*). Some different impediments to the understanding of the meaning of a statement have been mentioned by Vatsyayana while explaining one variety of point of defeat (NS v.2.9): employment of a word having various meanings (*slista-sabda*), using a word in a sense not well-known (*apratita-prayoga*), and uttering words in a very quick succession (*atidrutoccarita*).

The first form of *vakyadosa*, the deficient, occurs if any one of the five steps necessary for the establishment of a position—thesis, probans, instance, application and conclusion (see *supra*, under *sthapana*)—is left out. Alternatively, it is said to occur when one claims as a starting proposition that one's thesis is established by a number of probantia, but actually seeks to establish it only by one probans. According to the NS (v.2.12), the deficient is a form of point of defeat, though only in the first sense given above.

The redundant is defined in three ways. Perhaps the CS tries to record the different traditions current.

First, it is said to be just the opposite of the deficient, i.e. if for any one of the five steps more than one are given, although only one would have been sufficient. In this sense, the redundant is considered a point of defeat by the NS (v.2.13), though it is specifically stated that the fault would occur if the probans or the instance mentioned is more than one. It has been further pointed out by later commentators that it would be a case of the redundant if one of the contestants in a debate does so, initially agreeing to the rule that more than one probans or instance will not be stated.

Secondly, it would be a case of the redundant, when, for instance, a discussion is going on on Ayurveda, but one speaks about the doctrine of Brhaspati or of Usanas or anything else similarly out of context. In this sense, again, the redundant becomes somewhat similar to a point of defeat admitted by Gautama and called the irrelevant (*arthantara*, NS v.2.7). It occurs when the proponent or the opponent states samething the meaning of which has no connection with the matter under discussion.

Thirdly, the redundant consists in useless repitition (*punarukta*), when the same implication, though having relevance to the context, is unnecessarily stated twice. Repetition is of two kinds, meaning-repetition and word-repetition. The first is conveying the same meaning over again by different words (e.g. *bhesajam ausadham sadhanam* ; medicine, medicine is the means for curing a disease), and the second is repeating the same word (e.g. *bhesajam bhesajam*).

According to Gautama, *punarukta* is an independent form of point of defeat. But his treatment is more technical and involved with his special subject-matter, logic and debate. He defines two varieties of it. First, it occurs 'when the same words or meanings are mentioned over again, except in the case of reiteration (*anuvada*)'. Repetition is useless re-statement, while reiteration is purposive re-statement (e.g. when it is said 'one is cooking and cooking', the repetition serves to indicate the uninterruptedness of the activity of cooking). The former is inadmissible, but the latter is justified. Thus, according to Gautama, *nigamana* (conclusion), the last inference-component, is a justified re-statement of *pratijna* (thesis), the first inference component. Secondly, it would also be a case of repetition if some meaning, already clearly understood from implication, is expressed over again through words appropriate for it. Vatsyayana gives an illustration : 'One first says, sound is non-eternal, because it is a product ; next, one states the meaning (over again) which clearly follows therefrom by implication... namely, whatever is not a product is eternal... Words are employed to convey some meaning. But in such a case the intended meaning has already been understood from implication.'

The meaningless occurs, for instance, when some letters are uttered in succession without conveying anything—*ka*, *ca*, *ta*, *ta* (dental), *pa*. This is exactly the same as Gautama's *nirarthaka* (NS v.2.8), an independent form of point of defeat.

The unconstrued is a statement in which the words, if taken separately, yield meanings, but they do not present a complete sense as mutually connected. For example, when one utters at random the words *cakra* (wheel), *nakra* (crocodile), *vamsa* (family), *vajra* (thunder) and *nisakara* (moon). Gautama's *aparthaka* also (NS v.2.10), an independent form of point of defeat, stands exactly for the same.

The contradictory is what is contradicted by either the instance (*drstanta*), or an accepted conclusion (*siddhanta*), or context (*samaya*). The first is illustrated when a physician says 'just as cold water produces heat so also does fever' and the second when he says 'a medicine cannot cure a disease'.

The contexts, according to the CS, are three: that of the followers of Ayurveda, that of the followers of ritual (*yajnika*) and that of the followers of Moksasastra. The first says that medicine has four vital limbs (*catuspada*), the second that beasts are to be collected for killing in a sacrifice by the sacrificers and the third that one should practise non-injury (*ahimsa*) to all beings. If one speaks in contravention of one's own context, it would be a case of the contradictory.

According to both Nyaya and Vaisesika, the contradictory is a form of pseudo-probans (*hetvabhasa*). Gautama (NS i.2.6) defines it as what contradicts one's own accepted conclusion and thus it would correspond to the second variety of the contradictory given by the CS. On a different occasion (NS i.2.1 ; definition of *vada*), Gautama specifies that in a *vada* debate one should make only such statements as do not go against an accepted conclusion (*siddhanta-aviruddha*). The implication of Gautama, according to Vatsyayana, is that in such a debate only a pseudo-probans may be employed, but there should not be any employment of any other point of defeat.

Prasastapada defines the contradictory as a probans which is not present either in *paksa* (the spot in which the presence of the probandum is going to be established) or in any *sapaksa* (an indisputable locus of probandum) and is present in every *vipaksa* (an indisputable locus of the absence of probandum). For instance, when it is said, sound is eternal, because it is composed of parts. Here sound is *paksa*, all eternal things *sapaksa* and all non-eternal things *vipakṣa*. But neither sound nor any eternal thing is composed of parts, while every non-eternal thing is composed of parts. Thus the reason does not prove eternality, the intended property, but rather the opposite, non-eternality. This is very nearer to the definition offered by later Nyaya-Vaisesikas that the contradictory is a probans which is invariably related to the absence of probandum.

Moreover, while defining the first inference-component, *pratijna* (statement of thesis), and explaining its formulation Prasastapada says that it is to be a statement not contradicted by (among others) one's own system (*svasastra=siddhanta*). Thus a Vaisesika cannot start with the thesis that an effect is pre-existent (which is advocated by Samkhya), for his system accepts the pre-non-existence of an effect. Faulty formulations of a thesis are known as *pratijna-bhasa* or *paksabhasa*. The Nyaya tradition however does not recognise them on the ground that all such cases are vitiated by one or the other form of pseudo-probans and as such, their fallacious nature is already determined.

Next is excellence of a statement (*vakya-prasamsa*). If a statement, as regards the implication to be conveyed, is neither deficient nor redundant, is expressive, is neither unconstrued nor contradictory and if the meanings of its words are well-connected, it would be an excellent statement. Such a statement is beyond all censure.

Purposive distortion (*chala*) is admitted as a separate topic or category both by the CS and the NS and there is marked similarity in its treatment by both. According to the CS, it is a deceitful trickery, apparently conveying a meanin, but is actually meaningless, simply a fabrication in words. It is of two forms *vak-chala* (distortion resorting to ambiguity) and *samanya-chala* (distortion resorting to similarity).

> An illustration of the former is :
>
> Someone says : This physician is a *nava-tantra* (i.e. one who has newly studied the system ; *nava*=newly).
>
> The physician objects : I am not a *nava-tantra* (i.e. one who has studied nine systems ; *nava*=nine), I am an *eka-tantra* (i.e. one who has studied only one system).
>
> The other clarifies : I do not mean that you have studied nine systems, I mean that you have newly (*nava*) studied the system. The physician persists : I have not studied the

system nine (*nava*) times only, I have studied it innumerable times.

An illustration of the latter is : 'Someone says that a medicine is capable of removing a disease. To this, another says, what do you say ? Do you mean that the existent (*sat*) is capable of removing the existent (*sat*)? The disease is something existent and the medicine too is something existent. If it is claimed that the existent is capable of removing the existent, then, we may as well say that even cough (*kasa*) should be capable of removing consumption (*ksaya*) since cough and consumption are both existent'.

According to Gautama, *chala* is 'controverting the words of a speaker by way of inventing a meaning contradictory to the meaning actually intended by him'. He speaks of three forms of *chala* of which the first two are the same as the ones described above. The third form, called *upacara-chala*, is raising an objection by accepting the primary meaning when what is actually intended is the secondary meaning. Thus one says 'the platform (*manca*) is shouting' by using the word 'platform' in a secondary sense to mean 'person on the platform'. But someone else objects by taking the word in its primary sense, how can the non-sentient platform shout ?

Gautama further notes that there are some who object to the threefoldness of *chala*. It is argued that there is no difference between *vak-chala* and *upacara-chala* as in both there is invention of a meaning which is not actually intended. But he defends his own classification by pointing out that, in *vak-chala*, the meanings intended as well as invented are both primary, whereas in *upacara-chala*, the meaning intended is secondary but the meaning invented is primary.

The term for a pseudo-probans or fallacious reason is *ahetu* in the CS and *hetvabhasa* in the NS. There is difference in classification also. According to the latter (i.2.4), it is of five forms, namely, irregular (*savyabhicara*), contradictory (*viruddha*), counter-acted (*prakaranasama*), unproved (*sadhyasama*) and mistimed (*kalatita*). The former however speaks of three forms: *prakarana-sama, samsaya-sama* and *varnya-sama*.

Of these three, the first may be illustrated as follows. Someone contends that the self being distinct from the body must be central. The argument seems to be that the body and the self are distinct entities ; hence, they must be dissimilar in nature.

The body is non-eternal. So the self must be eternal. But the argument is fallacious as the fact advanced as the ground, the distinction of the self from the body, is yet to be established. Only a fact as is already clearly established can be offered as a ground.

But Gautama includes *prakaranasama* in the lists of both fallacious reasons and futile rejoinders (*jati*), one of the sixteen categories in Nyaya. The treatment again is quite different. Rather the *prakarana-sama* of the CS appears to be very similar to the fallacious reason called *sadhyasama* (NS i.2.8) in Nyaya. As a fallacious reason, Gautama defines it (NS i.2.7) to be a mark which is employed to determine exclusively one character only, though in point of fact it can only give rise to a suggestion about the possibility of two opposite characters. Thus, one says 'sound is eternal, because, no property of a non-eternal thing is found in it' and another opposes 'sound is non-eternal, because no property of an eternal thing is found in it'. Here the grounds prove nothing, but only point to possibilities. In later Nyaya, it is better known as *sat-pratipaksa* and there is much controversy regarding its nature and function among not only the Naiyayikas but also the logicians of other schools.

It is interesting to note that after explaining and illustrating this fallacious reason according to his own view, Uddyotakara refers to and rejects an illustration of the same as given by 'others', which is essentially the same as the one given here by the CS. According to Uddyotakara (and Vacaspati), it may be an illustration of the variety called the irregular.

As a futile rejoinder, *prakarana-sama* occurs when the inference of the proponent and the counter-inference of the opponent are both equally strong, and none being capable of negating the other, both the positions appear to be established and no final conclusion is reached.

Samsaya-sama occurs when the very fact that causes a doubt is offered as the remover of the doubt. A man quotes a passage from Ayurveda. So someone is in doubt : Is this man a physician ? But somebody else tries to remove it by saying 'since the man quotes a passage from Ayurveda he must be a physician'. The cause of doubt and of its removal is the same, quoting a passage from Ayurveda, and no independent ground for the conclusion is stated.

In the NS (v.1.14), again, *samsaya-sama* too is treated as a futile rejoinder. It means raising an objection by showing that there is scope for a doubt due to the apprehension of common characteristic. Someone argues that sound is non-eternal, because, like a jar, it is a product. But an opponent objects. He accepts that sound is similar to a non-eternal thing, the jar. But sound, he argues, is also similar to an eternal thing, the universal (*samanya*), in that both can be perceived by an external sense. Then, why not consider it eternal, like the universal ? Thus there is no way of ending the doubt about sound's non-eternality or eternality.

Anyway, that the tradition recorded by the CS was also current is corroborated by a remark of Vatsyayana (on NS i.2.7): 'when some common characteristic which is really a cause of doubt is offered as a probans, it is a case of *samsaya-sama* ; but it is in fact nothing but a case of the irregular'.

The term *varnya-sama* literally means 'what is the same as what is yet to be proved (*varnya=sadhya*).' The illustration of the CS is as follows. An inference is offered, namely, knowledge is non-eternal, because it has no touch, just like sound. But the reason is fallacious, for, as it is in the case of knowledge, in the case of the instance, sound, also, non-eternality on the ground of touchlessness is yet to be proved.

According to Gautama, *varnya-sama* is a form of futile rejoinder, closely related to another called *avarnya-sama*. As Vatsyayana explains them : 'The word *varnya* means a thing which is sought to be established as the locus of a property (namely, the subject or *paksa*) and *avarnya* means the opposite (i.e. a thing which is already established as the locus of that property, namely, the instance cited). When these characteristics of the subject and the instance are unduly imputed upon each other conversely there result the futile rejoinders known as *varnya-sama* and *avarnya-sama*. In short, the subject is *varnya* and the instance *avarnya*. If the instance is presented as *varnya*, it is *varnya-sama*. If again the subject is presented as *avarnya*, it is *avarnya-sama*.

There is also another form of futile rejoinder, similar in nature, called *sadhya-sama* (NS v.1.4). It occurs if the opponent objects by saying that the instance has the same status as the subject ; the presence of the inferable property is yet to be proved not only in the subject but also even in the instance. Considering the illustration (and also Cakrapani's comments), *varnya-sama* of the CS appears to be identical with it.

Again, *sadhya-sama* occurs also in Gautama's list of pseudo-probans. If a fact not yet properly established is offered as the ground for an inference, it would be a case of *sadhya-sama*. For instance, when it is argued 'shadow is a substance, because it has movement'; movement of shadow is not a proved fact (according to the Nyaya-Vaisesika), the illusion is created really by the movement of light. The brief definition of *varnya-sama* given by the CS seems to agree with it. (Also *supra, prakarana-sama*).

The mistimed (*atitakala*) is explained in two ways. First, it is said to occur when what is to be stated earlier is stated later. Such a statement, since it is made after the proper time has elapsed, becomes unacceptable. According to Chakrapani, the mistimed (in this first sense) occurs if the inference-components are mentioned in violation of the proper order (i.e. thesis, reason, instance, application and conclusion). In that case, it would be the same as Gautama's *apraptakala*, a form of point of defeat (NS v.2.11). It is however not clear from the text that the CS refers specifically to the mis-timing of inference-components.

Besides *apraptakala*, a form of pseudo-probans also, called *kalatita* (=*kala-atita*), is recognised by Gautama. It is simply defined as a mark which is put forward after the proper time has elapsed. The definition is far from clear and there is a good deal of controversy about its nature among the later Naiyayikas. The interesting point however is that in the concluding portion of his commentary on the *sutra* defining *kalatita* Vatsyayana specifically points out that it woud be illogical to interpret this fallacy as consisting in the violation of the order of the inference-components. From Vacaspati's comment it appears that such an interpretation might have been made by the Buddhists.

Secondly, the mistimed is explained as follows. In a debate one of the contestants commits a point of defeat, but the other does not immediately point to the fact, he raises the point later on, when the debate has proceeded further. But it would be of no avail as the proper time has passed. In this sense, however, it would be identical with what Gautama calls *paryanuyojyopeksana*, a form of point of defeat.

The next two topics, censure (*upalambha*) and rejection (*parihara*), are simple. The former consists in pointing out that the reason put forward is fallacious, and the latter in refuting the charge. They are not given any special status in Nyaya, though there are innumerable instances of the use of the words *upalambha* and *parihara* in the above senses in Indian philosophical literature.

Loss of thesis or *pratijna-hani* means giving up the thesis originally advanced, when confronted with objections. There is, in Nyaya, a point of defeat, called *pratijna-sannyasa* (*sannyasa*= giving up), which exactly corresponds to it. However, a different form of point of defeat with the name *pratijna-hani* is also recognised by Gautama. It is said to occur if one admits in one's own instance the presence of an (unacceptable) property belonging to the counter-instance. One argues, sound is non-eternal, because it is perceived by an external sense, like a jar. An opponent objects. Jar-ness (*ghatatva*), a universal inhering in the jar, is also perceived by an external sense, but it is eternal. Here jar-ness is the counter-instance. If one goes on to admit 'let then the jar too be eternal', one would commit such a point of defeat. 'Eternality', a property of the counter-instance, jar-ness, is accepted as a property of the instance, the jar.

Acceptance (*abhyanujna*) is admitting what is desirable for the opponent but undesirable for the proponent. One says to another 'you are a thief'. The other, instead of proving his honesty only says in retaliation 'you also are a thief'. Here 'being a thief' is desirable for the former, but undesirable for the latter, and the fact becomes as good as admitted by the latter. This is the same as Gautama's *matanujna*, a form of point of defeat, which occurs when one admits a fallacy in one's own position (as alleged by the other) and attributes the same to the other's position.

The term *hetvantara* literally means a 'different probans'. It has been explained as follows (S. N. Dasgupta, *A History of Indian Philosophy*, vol. ii, p. 388) : '*Hetv-antara* (lodging with a wrong reason) is where, when the cause of some root fact (*prakrti*) is asked, the reply refers to the cause of the modifications or manifestations (*vikrti*) of the root fact.' Gautama too mentions a form of point of defeat called *hetvantara,* which however seems to be different. Thus, the proponent offers a ground in a general way. The opponent finds fault with it. To refute the objection the proponent states the ground in more specified terms by adding some qualifying expression. It would then be a case of *hetvantara*. Anyway, the definition given by the CS is far from clear and Cakrapani also does not provide any helpful hint.

The irrelevant (*arthantara*) occurs when a person who ought to speak about one thing actually speaks about another thing. For instance, one is asked about the symptoms of fever, but one speaks about the symptoms of urinary affection. This is same as Gautama's *arthantara,* which is considered a form of point of defeat.

The last of the topics, *nigrahasthana* or point of defeat, is defined in simple terms, giving practically its synonym only, namely, 'being defeated'. In other words, it consists in committing an offence because of which one is declared defeated by the assembly. In the first instance, the CS speaks of three such cases. Thus, a contestant would be declared defeated if, before a learned assembly, he (i) fails to comprehend a statement, though repeated thrice, (ii) censures one who is not censurable and (iii) does not censure one who is censurable.

According to Gautama, a point of defeat consists in the misconception (*vipratipatti*) or ignorance (*apratipatti*) on the part of a contestant (NS i.2.19). Vatsyayana explains the term *nigrahasthana* in exactly the same words as used here by the CS. The NS enlists in all twenty-two forms of it and all the three above cases are included in them (NS v.2.9, v. 2. 22 and v.2.21).

As if on second thought, the CS also includes some of the independent topics already discussed in the category of point of defeat. These are : loss of thesis, acceptance, the mistimed, pseudo-probans, deficient, redundant, useless (*vyartha,* i.e. *aparthaka*, under flaws of a statement), meaningless, repitition, contradictory, different probans and irrelevant. As we have already noted, with one or two exceptions, they are all included in Gautama's list of 'point of defeat'.

The *hetvabhasa*-s are proper fallacies of inference. The *jati*-s are the means, more unfair than fair, for silencing the opponent. The *nigrahasthana*-s are but the rules of conduct to be observed in a debate. Apparently there prevailed different traditions regarding all these. There must have been controversies as to their nature and scope. The same name was applied to a *hetvabhasa* or a *jati*. The same kind of fallacy was also known by different names. Similar fallacies were classified differently. The CS (in the section we are discussing) and the NS try to record and accommodate the different traditions in their own way.

Of course, this is also true of the system of logic as a whole. There might have been current different versions or schools of the Nyaya itself, though the earliest systematic work on ancient Indian logic now available to us is Gautama's *Nyayasutra* only. Undoubtedly, the version presented by the CS is much older. Moreover, the primary preoccupation of the CS is naturally with medicines and diseases and not with logic itself. It is aware of the necessity of adopting a scientific methodology and as such, cannot totally dispense with the study of logic. But at the same time it can neither get itself bogged down in irrelevant, intricate, metaphysical or epistemological questions. So what the CS really wants is to provide the physicians with a short and handy manual of logic, which more or less the eighth chapter of the Vimanasthana is.

A. *List of categories in the* Caraka-samhita.

1. Debate (*vada*).
2. Substance (*dravya*).
3. Quality (*guna*).
4. Action (*karman*).
5. Universal (*samanya*).
6. Particularity (*visesa*).
7. Inherence (*samavaya*).
8. Thesis (*pratijna*).
9. Establishment (*sthapana*).
10. Counter-establishment (*pratisthapana*).
11. Instrument of cognition (*hetu*).
12. Corroborative instance (*drstanta*).
13. Application (*upanaya*).
14. Conclusion (*nigamana*).
15. Rejoinder (*uttara*).

16. Proved doctrine (*siddhanta*).
17. Verbal communication (*sabda*).
18. Perception (*pratyaksa*).
19. Inference (*anumana*).
20. Tradition (*aitihya*).
21. Analogy (*aupamya*).
22. Doubt (*samsaya*).
23. Incentive (*prayojana*).
24. Irregular (*savyabhicara*).
25. Enquiry (*jijnasa*).
26. Ascertainment (*vyavasaya*).
27. Implication (*arthapatti*).
28. Origin (*sambhava*).
29. Censurable (*anuyojya*).
30. Non-censurable (*ananuyojya*).
31. Query (*anuyoga*).
32. Re-query (*pratyanuyoga*).
33. Flaws of statement (*vakya-dosa*).
34. Excellence of statement (*vakya-prasamsa*).
35. Purposive distortion (*chala*).
36. Pseudo-probans (*ahetu*).
37. Mistimed (*atitakala*).
38. Censure (*upalambha*).
39. Rejection (*parihara*).
40. Loss of thesis (*pratijnahani*).
41. Acceptance (*abhyanujna*).
42. Wrong probans (*hetvantara*)..
43. Irrelevant (*arthantara*).
44. Point of defeat (*nigrahasthana*).

B. *List of categories in the* Nyaya-sutra.

1. Instrument of valid knowledge (*pramana*).
2. Object of valid knowledge (*prameya*).
3. Doubt (*samasya*).
4. Incentive (*prayojana*).
5. Corroborative instance (*drstanta*).
6. Proved doctrine (*siddhanta*).
7. Inference-component (*avayava*).
8. Reductio (*tarka*).
9. Final ascertainment (*nirnaya*).
10. Discussion for final ascertainment (*vada*).
11. Debating maneuver (*jalpa*).
12. Destructive criticism (*vitanda*).
13. Pseudo-probans (*hetvabhasa*).
14. Purposive distortion (*chala*).
15. Futile rejoinder (*jati*).
16. Point of defeat (*nigrahasthana*).

APPENDIX VII

VAISESIKA CATEGORIES IN THE CARAKA-SAMHITA

MRINAL KANTI GANGOPADHYAYA

In Sutrasthana (i. 27 ff), almost at the beginning of the work, there is a reference in the CS to what are known as the six categories (*padartha*) recognised by the Vaisesika system of Indian philosophy. They are introduced with a story. There was an assembly of great sages who were discussing about the health and wellbeing of the people. It was found that Indra, the lord of the gods, could instruct properly on the science of longevity and so Bharadvaja went to the abode of Indra and received the wisdom from him. The other sages acquired it from Bharadvaja, and then with the 'eye of wisdom' (*jnanacaksus*), they saw the 'six', namely, *samanya, visesa, guna, dravya, karman* and *samavaya*. All these names stand for what are recognised as the basic categories by the Vaisesika, and the six are mentioned in the *Vaisesika-sutra* (VS) of Kanada itself (i.1.4). The order in which they are mentioned is however different. The order in which they are invariably enumerated and discussed in Vaisesika works is : *dravya, guna, karman, samanya, visesa* and *samavaya*. Naturally, the treatment too is different. One is meant for medical practitioners, and the other for philosophers. In the case of some, the concepts are quite different, though the names used are the same. As there are greater points of agreement in the treatment of *dravya, guna, karman* and *samavaya*, we shall take up these first.

On substance (dravya)

Substances have been enumerated and classified in the CS in quite a number of different ways, from the medical standpoint as well as otherwise.

The first enumeration of substances in the CS (Sutrasthana i.48) is the same as that in the VS. The substances are : *akasa* and others, self, mind, time and space. Cakrapani explains that '*akasa* and others' stands for the five *mahabhuta*-s, namely, *akasa*, air, fire, water and earth, enumerated later by the CS itself (Sarirasthana i.27). At the same time, they are also divided into two classes, conscious (*cetana*), having a sense-organ and unconscious (*acetana*), being without a sense-organ. This latter division, though not specifically mentioned in the VS, would not be seriously objected to by the Vaisesikas.

The definition of substance also, as given by the CS, agrees completely with the one accepted by the Vaisesika (CS, Sutrasthana i.51 and VS i.1.15). A substance is the locus of actions (*karman*) and qualities (*guna*), and is also the inherent cause (*samavayi-karana*) of effects. The threefold classification of causes is a peculiarly Nyaya-Vaisesika concept. Thus, for a piece of cloth, we have as inherent cause the yarns, as non-inherent cause (*asamavayi-karana*) the conjunctions among the yarns and as efficient cause (*nimitta-karana*) all the other necessary factors. Of all the categories a substance alone can be the inherent cause. Although the CS here specifically mentions the fact, unlike the Nyaya-Vaisesika works, it does not deal with the theory of causes and its classification. Following later Nyaya-Vaisesika interpretations, Cakrapani, as usual, offers various intricate explanations and modifications of the definition.

As it is in the Vaisesika system, in the CS also, *akasa* and the other four are called *mahabhuta*-s (Sarirasthana i.27). Their qualities are respectively sound (of *akasa*), touch (of air), colour (of fire), taste (of water) and smell (of earth). The Vaisesikas also accept this distribution of qualities. According to one principle of classification, they classify the qualities as general qualities (*samanya-guna*) which may belong commonly to many substances and specific qualities (*visesa-guna*) which belong to one particular substance only. These five qualities are all specific qualities. Thus, sound belongs to *akasa* only, (temperate) touch to air only, (brilliantly white) colour to fire only, (sweet) taste to water only and smell to earth only.

According to Cakrapani, sound and the others are the natural (*naisargika*) qualities of *akasa* and the others. But qualities other than the natural ones may be present in any of them when there is an 'admixture with a different element' (*bhutantara-pravesa*). Thus the distribution of these five qualities in these five substances would be (Sarirasthana i.28): (a) *akasa* has sound only; ; (b) air has touch and sound only ; (c) fire has colour, touch and sound only ; (d) water has taste, colour, touch and sound only ;

(e) earth has smell, taste, colour, touch and sound only. There is a brief discussion on this distribution of qualities in the *Nyaya-sutra* also (iii.1.62ff).

On a different occasion (Sutrasthana xxvi. 10 ff), it has been pointed out that, according to Ayurveda, all substances (which are products) are but an admixture of the five *bhuta*-s (*panca-bhautika*)—a view which is not endorsed by the Nyaya-Vaisesika The five are also described along with their special characteristics. Thus :

(a) Earth-substances are heavy, rough, hard, weak, unmoving, non-smeary, compact, large and have the quality of *gandha* in greater proportion. Such substances lead to growth, compactness, weight and stability.

According to Vaisesika, qualities of earth are : colour, taste, smell, touch, number, magnitude, separateness, conjunction, disjunction, contiguity and non-contiguity, heaviness, liquidity, and *samskara*.

(b) Water-substances are liquid, oily, cold, weak, soft, smeary and have the quality of *rasa* in greater proportion. Such substancs lead to wetness, oiliness, stickiness, ooziness, softness and are refreshing.

According to Vaisesika, qualities of water are : colour, taste, touch, number, magnitude, separateness, conjunction, disjunction, contiguity and non-contiguity, heaviness, liquidity and *samaskara*.

(c) Fire-substances are hot, strong, minute, light, dry, non-smeary and have the quality of *rupa* in greater proportion. Such substances lead to burning, digestion, colour-revealing light, shine and colours (*varna*).

According to Vaisesika, qualities of fire are : colour, touch, number, magnitude, separateness, conjunction, disjunction, contiguity and non-contiguity, liquidity and *samskara*.

(d) Air substances are light, cold, dry, rough, non-smeary, minute and have the quality of *sparsa* in greater proportion. Such substances lead to dryness, tiredness, movement, non-smeariness and lightness.

According to Vaisesika, qualities of air are : touch, number, magnitude, separateness, conjunction, disjunction, contiguity and non-contiguity and *samskara*.

(e) . *Akasa*-substances are soft, light, minute, smooth and have the quality of *sabda* in greater proportion. Such substances lead to softness, porousness and lightness.

According to Vaisesika, qualities of *akasa* are : number, magnitude, separateness, conjunction, disjunction and sound.

But this is not all. We have a few more classifications of substances as well.

According to their efficacy (*prabhava*), substances are said to be of three kinds (Sutrasthana i.67): (a) those alleviating evil effects (*dosa-prasamana*), (b) those vitiating the basic body-constituents (*dhatu-pradusana*), (c) those keeping one in normal state of health (*svastha-vrtti*). Naturally, we have no such classification in Vaisesika.

We have another classification, immediately following (*ibid*, i.68-73). Substances may be (a) *jangama* or produced from movable things, e.g. honey, milk etc. ; (b) *bhauma* or produced from the earth, e.g. gold, iron etc. ; and (c) *audbhida* or produced from plants, e.g. leaves, roots etc. This last again is of four types: (i) *vanaspati* (bearing fruits but no flower), e.g. the Banyan ; (ii) *virudh* (having tendency to spread), e.g. creepers ; (iii) *vanaspatya* (bearing fruits produced from flowers), e.g. the mango ; and (iv) *osadhi* (dying after the ripening of the fruit), e.g. the Sesamum.

One of the various definitions of *rasa* in the CS is that it is the object of the gustatory sense (*ibid*, i.64-66). There are six kinds of such *rasa*, namely, sweet, acid, salt, pungent, bitter and astringent. Thus, according to the difference in *rasa*, substances may be of 63 kinds (*ibid*, xxvi. 14):

(i) Having one *rasa*	6
(ii) Having two *rasa*-s	15
(iii) Having three *rasa*-s	20
(iv) Having four *rasa*-s	15
(v) Having five *rasa*-s	6
(vi) Having six *rasa*-s	1
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On quality (guna)

By way of defining quality, the CS (Sutrasthana i.51) states that a quality is what can reside through the relation of inherence (*samavaya*), does not possess action and can be a cause. The definition as such is far from clear. Cakrapani, however, relying on later Nyaya-Vaisesika interpretations and adopting later terminology tries to make sense out of it and show its satisfactoriness. Anyway the definition has nothing that would be unacceptable to the Vaisesikas. The VS (i.1.16), for example, says that a quality inheres in substances, does not itself possess any quality and is not an independent cause of conjunction and disconjunction.

In the Vaisesika view, there are twenty-four qualities. Kanada himself gives a list of seventeen, but seven more are added to it by Prasastapada. The CS gives us at least three lists of qualities : (i) Sutrasthana i.49 ; (ii) *ibid* xxv.36 and (iii) *ibid* xxvi.29. We shall first give the lists in the CS and then, and a list of qualities as accepted by the Vaisesikas.

The first list of the CS which follows the enumeration of substances is the most comprehensive as it refers to and includes the other two lists also. According to it, qualities are :

(a) Those known by the term *artha*, namely, sound, touch, colour, taste and smell. These are all admitted by the Vaisesika and also considered 'specific qualities'. The *Nyayasutra* (i.1.14) also applies the term *artha* to them.
(b) Those starting with *guru*, i.e. those enumerated in the second list.
(c) Knowledge (*buddhi=jnana*). This too is admitted by the Vaisesika.
(d) Those ending with effort. According to Cakrapani, the qualities meant are : desire, aversion, pleasure, pain and effort. They are all qualities of the self. Here we have complete agreement with the Vaisesika position.
(e) Those starting with *para*, i.e. those enumerated in the third list.

The second list of qualities, the one starting with *guru* (*gurvadi*), includes twenty:

(1) heavy (*guru*), (2) *light* (*laghu*), (3) cold (*sita*), (4) hot (*usna*), (5) oily (*snigdha*), (6) dry (*ruksa*), (7) weak (*manda*), (8) strong (*tiksna*), (9) unmoving (*sthira*), (10) moving (*sara*),

(11) soft (*mrdu*), (12) hard (*kathina*), (13) non-smeary (*visada*), (14) smeary (*picchila*), (15) smooth (*slaksna*), (16) rough (*khara*), (17) minute (*suksma*), (18) large (*sthula*), (19) solid (*sandra*) and (20) liquid (*drava*).

This list, which is really an enumeration of ten pairs of opposite properties, has the least agreement with the one accepted by the Vaisesikas. They seem to admit the first, the fifth and the last as such, the third as a variety of touch, the seventeenth and the eighteenth as varieties of magnitude (*parimana*). The rest are not at all admitted. Moreover, what is more important is the fact that in the CS these are not enumerated as qualities of substances in general or in the technical sense, but only as qualities of food taken (*ahara*).

In the third list, we have ten qualities. The list begins with *paratva* and *aparatva*. '*Para* means superiority or importance (*pradhana*), *apara* means inferiority or unimportance (*apradhana*). This importance or unimportance is with reference to country, time, age, measure, the *rasa* resulting from digestion (*paka*), potency (*virya*), and taste (*rasa*). Thus, a dry country is called *para* and a marshy one *apara* : the rains (*visarga*) of early and late autumn (*sarat* and *hemanta*) are called *para,* whereas the season of drought (winter, spring and summer) is called *apara ;* with reference to *paka, virya* and *rasa, para* and *apara* mean suitability and unsuitability—that which is suitable to one is *para* and that which is unsuitable to one is *apara*'.

The others are : *yukti* (proper selection of medicine with reference to a particular disease), *samkhya* (number), *samyoga* (conjunction), *vibhaga* (disjunction), *prthaktva* (separateness), *parimana* (measurement by weight), *samskara* (production of new qualities) and *abhyasa* (constant practice).

The Vaisesikas admit *paratva, apartva, parimana* and *samskara,* though in a quite different sense. *Samkhya, samyoga, vibhaga* and *prthaktva* are the same according to both. The other two, *yukti* and *abhyasa,* are not considered qualities by the Vaisesika. We give below the list of twenty-four Vaisesika qualities :

1. Colour (*rupa*) : quality perceived by the visual sense. Of many varieties. Present in earth (all varieties), water (only non-luminous white) and fire (only luminous white).

2. Taste (*rasa*) : quality perceived by the gustatory sense. Of six varieties—sweet (*madhura*), sour (*amla*), saline (*lavana*), pungent (*katu*), astringent (*kasaya*) and bitter (*tikta*). Present in earth (all varieties) and water (only sweet).

3. Smell (*gandha*) : quality perceived by the olfactory sense. Of two varieties—good (*surabhi*) and bad (*asurabhi*). Present only in earth.

4. Touch (*sparsa*) : quality perceived by the tactual sense. Of three varieties—cold (*sita*), hot (*usna*) and temperate (*anusnasita*). Present in earth (only temperate), water (only cold), fire (only hot) and air (only temperate).

5. Number (*samkhya*) : the special ground for the notion or use of numerical terms 'one', 'two' etc. Present in all substances.

6. Magnitude (*parimana*) : special ground for measuring (*mana*) a substance. Of four varieties—minute (*anu*), large (*mahat*), longness (*dirgha*) and shortness (*hrasvatva*). Large again of two varieties—large and infinitely large (*paramamahat*). Present in all substances. Atoms and dyads are 'minute'. From triad onwards all visible things are 'large'. Four substances—*akasa, kala, dik* and *atman*—are infinitely large.

7. Separateness (*prthaktva*) : special ground for the notion or usage "*It* is different from *that*". Present in all substances.

8. Conjunction (*samyoga*) : special ground for the notion or usage 'conjoined' (*samyukta*) ; occurs when two substances, previously lying apart, are joined together. Present in all substances.

9. Dispunction (*vibhaga*) : special ground for the notion or usage 'disjoined' (*vibhakta*) ; is a cause for the destruction of conjunction. Present in all substances.

10+11. Non-proximity (*paratva*) and proximity (*aparatva*) : Of two kinds : (i) spatial (*daisika*) : '*It* is farther from *that*': (ii) temporal (*kalika*) : 'It is older than *that*'. The one far away or older has *paratva* and the one nearer of younger has *aparatva*.

12. Weight (*gurutva*) : cause of initial downward movement. Present only in earth and water.

13. Fluidity (*dravatva*) : cause of oozing out or trickling down (*syandana*). Present only in earth, water and fire.

14. Viscidity (*sneha*) : quality by vitue of which particles of powder (*curna*) are agglutinated and held together in the form of a lump. Present only in water.

15. Sound (*sabda*) : quality perceived by the auditory sense. Present only in *akasa*.

16. Knowledge (*buddhi=jnana*) : ground for all forms of speech-act (*vyavahara*). Present only in the self.

17. Pleasure (*sukha*) :
18. Pain (*duhkha*) :
19. Desire (*iccha*) :
20. Aversion (*dvesa*) :
21. Effort (*prayatna*) :
22. Merit (*dharma*) :
23. Demerit (*adharma*) :

Present only in the self.

24. Tendency (*samskara*) : Of three kinds....

(i) speed (*vega*) : cause of subsequent movement. Present in earth, water, fire and air and the mind.

(ii) trace (*bhavana*) : cause of recollection (*smarana*). Present only in the self.

(iii) elasticity (*sthitisthapaka*) : quality which brings a thing to its normal shape. Present only in earth.

On action (karman)

The nature of *karman* is variously described in the CS. First of all, it seems to be identified with *prayatna* (effort) and is said to be known as *cestita* (exertion) (Sutrasthana i. 49). According to the Vaisesika, the term *prayatna* does not stand for *karman* ; it means a specific kind of quality (*guna*), a psychological or internal one, belonging to the self and produced by another such quality, desire (*iccha*). The term *cestita,* on the other hand, generally means physical action or movement of living beings.

Again, just after two verses, *karman* has been defined as what is the independent cause of conjunction and disjunction, and inheres in a substance (*ibid,* i.52). It is almost identical with the definition of *karman* as offered in the VS (i.1.17). According to the Vaisesika classification, there are five kinds of *karman* : (i) upward motion (*utksepana*), (ii) downward motion (*avaksepana*), (iii) contraction (*akuncana*), (iv) expansion (*prasarana*) and (v) general movement (*gamana*). The CS however does not give any such classification.

We have in the CS repeated references to and elaborate discussions on *panca-karman* or 'five actions'. But they have relevance for the medical context only. These 'five actions' are administering the following five : *vamana* (emetics), *virecana* (purgatives), *asthapana* (enemata), *anuvasana* (corrective or unctuous), and *sirovirecana* (errhines). (Vimanasthana viii.80 ; Kalpasthana i. 1ff and Siddhisthana i. 1ff.)

On inherence (samavaya)

Inherence is the last of the six which the great sages saw with the eye of wisdom. According to the CS (Sutrasthana i. 50), *samavaya* is non-separability (*a-prthagbhava*), such as, the intimate relation of earth and others with their qualities. It is eternal, because a substance is invariably present as characterised by its qualities.

According to the Vaisesika also, *samavaya* is an eternal relation and it subsists between things which are non-separable (*ayutasiddha=aprthagbhava*) ; an attempt at separating the two results in the destruction of at least one. Later, the cases of *samavaya* have been specifically fixed and enumerated. It is the relation between (a) part and whole, (b) substance and its quality or action, (c) universal and a substance or a quality or an action and (d) particularity and an eternal substance.

Cakrapani quoes the definition of *samavaya* as given by Prasastapada and claims that the definition of the CS agrees completely with it.

On samanya *and* visesa

The CS devotes two full verses to explain the nature of *samanya* and *visesa,* which have great relevance and importance for Ayurveda.

According to the first verse (Sutrasthana i.44), *samanya* is the cause for the increase of a thing (*bhava*). The implication seems to be that in the body similar things lead to the increase of similar things. For example, to increase flesh in the body one should eat more meat (cf. Sarirasthana vi.10). *Visesa* is exactly opposite in nature ; it is the cause for the decrease (*hrasa*) of an element. For example, with reference to one of the three humours of the body called *vata* (air), flesh is *visesa.*

It is further advised that if health is to be maintained, both *samanya* and *visesa* are to be judiciously applied. The application of the former alone will lead to undue increase of an element and that of the latter alone to its undue decrease and the balance of the basic body-elements (*dhatu*) will not be maintained.

Considering the above, the conceptions of *samanya* and *visesa* in the two, the CS and the Vaisesika system, become quite different. "In the Vaisesika system the word *samanya* means a class concept ; but here it means the concrete things which have similar constituents or characteristics ; and *visesa*, which means in Vaisesika ultimate specific properties differentiating one atom from another, means in Caraka concrete things which have dissimilar and opposite constituents or characteristics. . . . The principle of *samanya* and *visesa* is the main support of Ayurveda ; for it is the principle which underlies the application of medicines and the course of diets. . . . Instead of having only a conceptual value, *samanya* and *viseasa* are here seen to discharge a pragmatic work of supreme value for Ayurveda." (S.N. Dasgupta, *A History of Indian Philosophy,* Vol. ii, p. 371).

According to the second verse (*ibid,* i.45), *samanya* tends to unify (*ekatvakara*), it produces the notion of 'one' and fosters the idea of sameness (*tulyarthata*) ; *visesa,* on the other hand, tends to diversify (*prthaktvakrt*), it produces the notion of 'many' and fosters the idea of distinction (*atulyarthata*).

Taken in a general sense, such a conception of *samanya* would be very near to that of the Vaisesikas who also admit it as a single property present in many individuals which gives rise to a common notion (*anuvrttipratyaya*) with regard to them. "Our experience, in several cases where it relates to diverse objects, exhibits a certain degree of uniformity. When we see a human being or a beast our experience howsoever it may differ in other respects, invariably takes the form—'this is a man' (*ayam manusyah*) or 'this is a beast' (*ayaym mrgah*). The uniformity that we thus observe in our experience cannot be accounted for otherwise than through the assumption of a generic feature common to all mankind or all the beasts. This generic feature is called *manusyatva* (humanity) in the case of human beings and *mrgatva* (beasthood) in the case of beasts." (S. Kuppuswami Sastri, *A Primer of Indian Logic*, p. 21) Thus *manusyatva, mrgatva* and such other properties would be the examples of *samanya* in the Vaisesika view.

That *visesa* is a differentiating property, and exclusively so, is an accepted conclusion of the Vaisesikas also. It is however admitted in a very special and restricted sense as a property of eternal substances like the atoms and others which cannot be distinguished from one another by any other means. "Composite substances like a jar or a cloth, made of component parts, can easily be distinguished from each other by means of the different parts constituting them. Eternal substances, which are alike in respect of *guna*, *karma* and *jati*, like the eternal atoms of earth, water, fire or air, cannot be distinguished from similar substances of the same class without ascribing to them some unique feature called *visesa*" (*ibid*, p. 25f).

Although Cakrapani elaborately discusses the nature of *samanya* from the Ayurvedic standpoint, often referring to and criticising the interpretations given by others, he is rather inclined to take *samanya* in the CS as agreeing with the Vaisesika conception. He explains that the statement about *samanya* in the first verse does not give its definition (*laksana*). It only points out how *samanya* can have practical relevance for Ayurveda. Here *samanya* is to be taken in the sense of *samanyavat,* that which is characterised by *samanya,* for *samanya* itself cannot be the cause of increase. Cakrapani criticises the view that *samanya* is only to be considered equivalent to *samana* (of a similar kind) and therefore, in the sense of substances (*dravya*), for in that case there would be no sense in mentioning *samanya* as distinct from *dravya* in the initial list of the six (Sutrasthana i.28). He concludes with the comment that he has discussed the doctrine of *samanya* and *visesa* only so far as they are relevant for Ayurveda, for otherwise the discussion would be too lengthy and elaborate; for further details one would do well to go through Vaisesika works.

APPENDIX VIII

WAYS OF STUDYING TIBETAN MEDICAL LITERATURE

E. E. OBERMILLER

Translated from the Russian by
HARISH C. GUPTA

The programme drawn up by the All-Union Institute of Experimental Medicine for an all-round study of the medicine of the East includes the medicine of Tibet and Mongolia as one of the main fields. Along with the practical aspect and clinical, pharmacological and other investigations, it is envisaged to study systematically that vast literature in which the native scientific tradition found expression and which is of quite exclusive importance, above all from the point of view of history of medicine in the broad sense. A considerable amount of literary material essential to a scholar of the subject is now at our disposal. The expeditions sent by the All-Union Institute of Experimental Medicine acquired from the Buryat-Mongolian Autonomous Soviet Socialist Republic vital texts relating to the field under study. These texts have been published by xylographic process in the Agin *datsan** in eastern Buryatia ; besides, some publications have been acquired direct from Tibet. Any systematic analysis of the said literature has essentially to be prefaced by a general review and characterisation of the material, and it is also necessary to outline in general the order which would be followed by us in handling the material to be analysed. This precisely is the main aim of the present article.

In the literature to be studied a pivotal position is held by a text, the full title of which in translation reads : "The Essence of the Medicinal : A Treatise, Containing Secret Precepts Concerning Eight Main Articles of Medicine" (*dhud-rtsi-snin-po-yan-leg-brgyod-pa-gsan-ba-man-nag-gi-rgyud*)[1], and which in Tibetan is mentioned usually by its short title *rGyud-bshi*, that is, "Four

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**datsan*—in Mongolian, a Buddhist monastery.—Tr.

[1] About these eight articles or "members" see *infra*.

Treatises", as per its four main sections.[2] This text already attracted the attention of scholars long ago, and there are many works devoted to it. First of all, we would refer to these.

The foremost amongst these, understandably, is the work of the pioneer of Tibetology in Europe, viz. of the Hungarian scholar Alexander Csoma de Koros. In 1835 he published in Calcutta, in the Journal of the Asiatic Society of Bengal (vol. IV), a survey of the contents of *rGyud-bshi* under the title "Analysis of a Tibetan Medical Work", which mentions the chapter headings of all the four sections and gives a short exposition of these on the basis of a summary made for the author by an acquaintance of his, a Lama-physician.

In Russian language the first work devoted to *rGyud-bshi*, and evoking an interest in the practical application of Tibetan medicine in our country, is ascribed to P.A. Badmaev, and is entitled *Osnovy vrachebnoi nauki Tibeta* [Principles of Medical Science of Tibet]. As is known, it was owing to the stimulus provided by this work that the Russian scholar, A.M. Pozdneev, who had taken up the study of *rGyud-bshi* from the Tibetan and Mongolian texts as early as in the 70's of the 19th century, reverted to his investigations once again in 1898, and the result was the Russian translation of the first two sections of *rGyud-bshi* published in 1908. Pozdneev's work acquired particular significance because it was in the context of this work that the Tibetan medicines began to be collected and taken up for investigation for the first time in the museum of the Botanical Garden at St. Petersburg.

A little earlier, in Germany, a physician Heinrich Laufer, working jointly with his brother, the well known Tibetologist, Berthold Laufer, published a work under the title *Beitrage zur Kenntnis der tibetischen Medicin* (1900). This work is important to us, above all because of the vast bibliographical material contained in it. From the works in Russian language Laufer mentions the brochures of Ptitsyn, Kirillov and Kaplunov. At many places Laufer has characterized the Tibetan and Mongolian Lama-physicians. Much attention has been given by him to the question of spread of various diseases in Tibet. The content of *rGyud-*

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2. These sections are : (1) rTsa-rgyud—the main section, general arrangement ; (2) bSad-rgyud—the descriptive section ; (3) Man-nag-rgyud—the section of medical practice ; and (4) Phyi-ma'i-rgyud—the supplement.

bshi which provides the basis for his work, is given in accordance with the "Analysis" of Csoma de Koros.

Lastly, for full listing of all the works related to *rGyud-bshi*, we may also mention the literal translation of the first section ascribed to Damba Ul'yanov, the Helon of Kalmykia.

Analysing all the said works, we see that these do not go beyond transmitting the content of or just translating *rGyud-bshi*; the text of *rGyud-bshi* is taken in isolation, that is, without paying any attention to that vast literature with which it is most closely related. The reasons for this have to be sought for in the lack of adequate familiarity with the medical literature of Tibet as collected, which has only lately become accessible to us.[3] This is why quite often the translation made was wrong, and this resulted in misunderstanding it, and sometimes, in a number of cases, even forming a corrupted notion of its content on the whole. The most important task therefore must be that of familiarity with those major works with which our treatise has a direct organic link. A correct understanding of the scientific terminology and a correct interpretation of the most difficult themes would be possible only on studying the entire literature available to us. It must be remembered that we are dealing not with a solitary text but with a whole scientific system, for understanding which we must make use of all the data. Only then shall we have a clear and accurate notion of the given system.

First of all, it must be remembered that what we call "Tibetan medicine" is basically by no means an original creation of the Tibetan soil. And here, as in all other domains of culture of Tibet, the original home is India. The spread (beginning with the 7th century A.D.) of Buddhism in Tibet was accompanied by the penetration into Tibet of those scientific disciplines which were dominant in the India of that time, also including the Indian medical science. It is enough to mention that the very text of *rGyud-bshi*, in its original form, is regarded as a translation from Sanskrit, and that the entire scientific terminology and all scientific special symbols are literal rederings of Sanskrit words and expressions. It is therefore quite clear that the Tibetan medical literature cannot be studied outside the context of the medicine of

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3. Laufer (p. 21) speaks of inadequate clarity, resulting from non-familiarity with the text of Vaidurya-snon-po, the detailed commentary on the *rGyud-bshi*.

India,—these are one school, one system. Greatly valuable for a knowledge of Indian medicine is the work of Professor J. Jolly of the Wurzburg University—entitled *Medicin, Grundriss der Indo-Arischen Philologie and Altertumskunde* (Strassburg, 1901). In this work we have a complete survey of the Indian medical literature from the most ancient times to our days and an exposition of the principles of Indian medicine, formulated on the basis of the main sources. Thanks to J. Jolly's work containing, besides, exceptionally copious bibliographical material, we have the opportunity of an easy orientation in the literature, which considerably facilitates our work.

The origins of the medical science in India go back to very remote times, coinciding with the Vedic period. The fourth Veda, viz. the *Atharvaveda*, had a supplement, the so called *Ayurveda* —"the science of prolongation (or maintenance) of life". Here already is the traditional division of medicine into eight main elements or "units" (*anga*), which in the initial form are : (1) (*salya*)—the section of treatment of wounds ; (2) *salakya*—the treatment of diseases, pertaining to the head area ; (3) *kaya-cikitsa*—the treatment of diseases covering the whole organism ; (4) *bhuta-vidya*—the section of psychic diseases, ascribed to the effects of evil spirits ; (5) *kaumara-bhrtya*—the treatment of children's diseases ; (6) *agada-tantra*—the anti-poison treatment; (7) *rasayana-tantra*—the treatment with elixirs, the means against the lassitude of the old age ; and (8) *vajikarana-tantra*—on the means, enhancing the sexual activity.

This oldest medical tradition was initially an attainment of the Brahmana clans. One of the persons specially distinguished amongst its bearers was the sage (*rsi*) Atreya (in Tibetan rendering, *rGyun-ses-kyi-bu* or, according to Mongolian pronunciation, *Chhyun-shei-chhi-bu*). The legend states that he performed exceptionally daring surgical operations. The work *Atreya-śamhita* extant today is attributed to him.

A distinguished personality in the Indian medical world thereafter was Caraka, whom the Chinese sources place in the 1st-2nd centuries of our era, although the possibility of still earlier date is not ruled out. His work *Caraka-samhita* has eight sections or branches (*sthana*)[4], namely : (1) *sutra-sthana*—the section of general positions, including pharmacology, dietetics, physiology etc. ; (2) *nidana-sthana*—the description of diseases ; (3) *vimana-sthana*—about the importance of tastes, food, general pathology ; (4) *sarira-sthana*—anatomy and embryology ; (5) *indriya-sthana*—diagnostiec and prognostics ; (6) *cikitsa-sthana*—special therapy ; (7) *kalpa-sthana* ; and (8) *siddhi-sthana*—general therapy.[5]

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[4] On the basis of these eight sections, the Tibetans call Caraka's work *Tsa-ra-ka-sde-brgyad*.

Another person to be considered the greatest authority on medicine is Susruta, who should be placed latest in the 7th century, although there are data which permit talking of a considerably greater antiquity. The material in his *Susruta-samhita* is arranged under six sections mentioned below : (1) *sutra-sthana*—the section of general positions, like the training and preparation of physicians, dietetics etc., but also containing a special section devoted to surgery ; it is characteristic that the author regards surgery as the most important branch in the whole medicine[6] ; (2) *nidana-sthana*—pathology ; (3) *sarira-sthana*—anatomy and embryology ; (4) *cikitsa-sthana*—theraphy ; (5) *kalpa-sthana*—the teaching about the poisons ; and (6) *uttara-sthana*—the additional section, containing special subjects, as for example, the basic diseases and their treatment. This treatise by Susruta became accessible and available to a wide circle of readers because of the English translation by Hoernle. One most vital fact is that the treatises of Caraka and Susruta were in their time translated into Arabic and Persian, and exercised an exceptionally singular influence on the medicine of the Near East.

Those to acquire great fame after Vagbhata—about whom we shall be talking presently in details—were Madhava known for his work *Madhava-nidana* (9th century), which in many ways follows the works of Caraka and Susruta, though, compared with them, does also contain many new things as, for example, a detailed chapter on pox[7]; and Vrnda known for his work *Siddha-yoga*, containing *inter alia* numerous prescriptions and some sorts of indications of mercury preparations.

A still later author was Vangasena, whose work *Cikitsa-san-*

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[5] Jolly, p. 12.

[6] It would not be without interest to mention that in Susruta there are indications of dissection of corpses—see Jolly, p. 44.

[7] *Ibid.*, p. 7.

graha, among other things, discusses in detail the treatment of haemorrhage and the use of iron in medicines.

Another personality Sarngadhara was from the 14th century; his work *Sarngadhara-samhita* is one of the remarkable works of Indian medicine. This work for the first time gives in great detail the mercury preparations and the ways of removing the poisonous properties of mercury. In the section of diagnostics we find detailed references to the feeling of pulse. We shall come back to these two things somewhat later in the context of their presence in the Tibetan medical texts and above all in the *rGyud-bshi*.

With this mention of Sarngadhara we may stop listing the authorities of Brahmanical India on medicine; the literature of the subsequent centuries does not have any special relevance for us, for it has no direct link with Tibetan medicine. We shall now turn to literature which is nearest to the Tibetan medicine.

A special place in the Indian medicine, though also allied to the general tradition, is held by the Buddhist medicine; and this is what is of immediate interest to us in view of its direct association with the Tibetan medicine. This is quite understandable, remembering the exclusive dominance of Buddhism and Buddhist culture in Tibet. The very text of *rGyud-bshi*, as is known, is regarded by trandition as coming from the Buddha himself. We know that, already in the earliest centuries of the existence of Buddhism, the Buddhist circles in India were taking an exceptional interest in medical problems. Such an old Buddhist text as the Pali *Mahavagga* (which a number of scholars are inclined to place in the 3rd or even in the 4th century B.C.), contains sections devoted to medical data,—which refer to the three main energies of organism, this extreme landmark stone of the Indian medicine, and also to the arious medicinal means like eye anointments, gallipots, sudorific drugs, various salts etc. A Buddhist legend repeatedly mentions the famous physician Kumara Jivaka (in Tibetan, 'Tsho-byed gZon-nu), presented as a disciple of the aforementioned Atreya and a contemporary of the Buddha Sakyamuni. According to the Buddhist tradition, starting with Kumara Jivaka, the medical knowledge was transmitted in uninterrupted sequence, successively through a number of teachers, right to Nagarjuna. The latter is identified with the famous founder of the Madhyamaka dialectical system (2nd century). In the Tibetan *bsTan'gyur* (the complete collection of translations of Buddhist philosophical and scientific literature), in volume CXVIII, we have Tibetan translations of three medical works attributed to Nagarjuna, namely: (1) *Yoga-sataka*; (2) *Jiva-sutra* ; and (3) *Ava-bhesaja-kalpa*, whose Sanskrit original have, unfortunately, not been found till this day.

While speaking of the oldest Buddhist medical literature, one cannot overlook the famous Bower manuscript found in Central Asia (in Kashgar) and containing three medical treatises,—of which one is devoted to curative properties of garlic, the second contains numerous prescriptions and the classification of various types of drugs, and the third is a list of 72 prescriptions. This manuscript, which on the basis of palaeographic data is placed in the 5th century A.D., has been published and translated by Professor Hoernle. It is important to note that there is a mention of Susruta in it.

From Nagarjuna's descendents in the medical line the Buddhist tradition assigns the first place to the famous Vagbhata[8], whose main work *Astanga-hrdaya-samhita* is closely linked with such authorities as Atreya, Caraka and Susruta, and contains references to them. Vagabhata, like Susruta, divides the material into six sections (*sthana*), namely; (1) *sutra-sthana*—the section of general positions ; (2) *sarira-sthana*—embryology and anatomy ; (3) *nidana-sthana*—pathology ; (4) *cikitsa-sthana*—therapy ; (5) *kalpa-sthana*—the teaching about the poisons ; and (6) *uttara-sthana*—a supplementary section which, incidentally, includes chapters on the diseases of eye, ear and nose.

The text of *Astanga-hrdaya-samhita* was published in India several times ; the Library of the Institute of Orientai Studies of the USSR Academy of Sciences has the Bombay edition, which we shall be using here in our study. Of all the medical works in Sanskrit language, this work of Vagbhata is undoubtedly of very great importance for us, for it is a direct connecting link between the Indian and the Tibetan medical literature. It enjoys such a position because there is a complete and accurate translation of it in Tibetan language in volume CXVIII of *bsTan-*

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[8] His other names are : Sura (Tib. Ba-vo), Matrceta (Tib. Ma-hol) or Pitrceta (Tib. Pa-hol).

'gyur, made by the famous translator (lo-tsa-va) Rin-chen bKan-po (11th century), with the participation of the Indian scholar Janardana. Having at our disposal both the versions, the original and the translated, we get quite an exceptional opportunity of studying them. On studying the original and the translation together, it would become possible to establish correctly the terminological parallels in both the languages ; we would know that such and such Sanskrit technical terms, words and expressions have equivalents in the Tibetan language permanently corresponding to them. And since the terminology is the same for the entire literature, and not for only one text, we would, thanks to this knowledge of terminological parallels, have the possibility of dealing with the Indian and Tibetan literature as a single whole. The example of other fields of Indian and Tibetan scientific literature has shown quite clearly how very important is the presence of one and the same source in both the languages and a correst knowledge of the equivalents. It is necessary to note that the translations of Sanskrit works into Tibetan language were made by Tibetan learned translators with the greatest accuracy, and that the rules worked out for this were most rigid, aiming at uniformity in translations and terminology. This was quite equally true of all fields of translated literature, including also the medical.

In the aformentioned volume CXVIII of *bsTan-'gyur* and in the subsequent volume (CXIX), occupying the latter completely, there is the Tibetan translation of a detailed commentary, written by Vagbhata himself on his own work, bearing the title *Astanga-hrdaya-vaidurya-bhasya.* This is followed by a still more detailed interpretation *Padartha-candrika-prabhasa,* the work of a Kashmiri physician Chandrananda, in three voluminous volumes (CXX, CXXI, and CXXII). The Sanskrit originals of these commentaries have unfortunately not so far been discovered ; if these were available, we would have had a far more extensive stock of technical terms and expressions in both the languages. In any case, the Tibetan translations, even a few, must by themselves provide copious materials—like the colossal work of Candrananda of Kashmir, in particular. This author enjoys a unique position, for he was the one to directly introduce the Indian medical science into Tibet ; according to the tradition, he translated into Tibetan the text of *rGyud-bshi* in its original form.

with the participation of the translator Vairocana (in Tibetan pronunciation, Biruzan).

In any case, the main text of Vagbhata plays a decisive role for us. Turning to our text of *rGyud-bshi*, we see that its terminology is largely the same as the terminology of Vagbhata, if we do not of course consider those places which in the *rGyud-bshi* represent something new, not having equivalents in Vagbhata. There is no doubt that both the texts, *rGyud-bshi* and *Astanga-hrdaya-samhita,* belong to the same scientific tradition. Comparing the terminologies of both the texts, we find that these are identical in a great majority of cases. As if this were not enough, we find expressed the same thoughts, and we find examples etc., which literally tally. Thus, we can point out places from chapters on the conception and development of embryo (*Ast*. II, and the beginning of the second section of *rGyud-bshi*). Knowing what Sanskrit technical terms correspond to the Tibetan, we can associate ourselves with the entire Indian literature of interest to us. The sphere of study, having direct relation to Tibetan medicine, would cover such texts as the treatises of Caraka, Susruta etc. Already now, on a cursory asquaintance, a whole series of equivalents have been established. Here, first of all, we shall mention the teaching about the three main energies of organism[9] with all their varieties. In respect of this teaching, the *rGyud-bshi* shows complete identity with the Indian texts. We shall also mention the identity in the classification of prescriptions and medicinal drugs etc. The compilation of an extensive Sanskrit-Tibetan and Tibetan-Sanskrit terminological dictionary on medicine would be of great significance for our work. Doing this on the basis of parallel texts (Sanskrit original and Tibetan translation) of *Astanga-hrdaya-samhita* must be one of our immediate tasks.

Having thus established the closest relationship of our main Tibetan medical treatise with the Indian medical literature, we can now give a correct analysis of the treatise itself. The question that first of all arises here is : does *rGyud-bshi* give something new compared with Vagbhata and his predecessors, and if so.

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[9] (a) Sanskrit *vata*=Tibetan *rlun ;* (b) Sanskrit *pitta*=*mkhris-pa ;* and (c) *slesman*=*bad-kan.*

what is this new thing? The Tibetan tradition says that after the text of *rGyud-bshi* was translated into Tibetan, a number of eminent Tibetan scholars worked on it. Of these, the most distinguished are gyu-thog-pa Yon-tan mGon-po "the senior" (ruin-ma) and gyu-thog-pa Yon-tan mGon-po "the junior" or "new" (gsar-ba). The latter, who according to some data should be placed in the 11th century, journeyed to Indian several times and improved his mastery there by studying the work of Caraka and other texts. He revised afresh the text of *rGyud-bshi,* adapting it for treatment in specific conditions of Tibet. In the process, it is said, he changed the text so much[10] that he is sometimes taken to be the real author of *rGyud-bshi* in its present version. A thorough study of the texts would give us a visual picture of those changes and additions which were made by gyu-thog-pa Con-tan mGon-po. Now already we can mention such an extremely important feature as the presence in the *rGyud-bshi* of the teaching about the diagnosing of diseases from the pulse, which is not there in Caraka, Susruta and Vagbhata. According to Jolly (p.22), in the Indian medical literature, a reference to pulse is found only in much later texts as, for example, in Sarngadhara's which was mentioned above. Jolly is inclined to believe that the feeling of pulse was borrowed by the Indian medicine from Arabia or Persia. The elucidation of this matter is clearly of great interest. Also of great significance is the question of the use of mercury and of rendering it harmless. In the works of Susruta and Vagbhata mercury is mentioned several times but, apparently, without precise indication of methods of eliminating its poisonous properties; and this is what is mentioned only in the later Indian texts. Incidentally, specific data are already available in the *rGyud-bshi,* in the fourth section (phyi-ma'i-rgyud), Agin edition 28 v, 1. A thorough study of Candrananda's vast commentary permits us to find out whether it contains something more detailed and developed on the given issues compared with Vagbhata, and whether the data of the aforementioned commentary tally with the data of *rGyud-bshi,* or should these latter be assigned to another source. In the course of study there would arise a whole series of questions touching upon the individual elements in the content of *rGyud-bshi*. Extremely important and interesting in this regard is the determining of mutual relationship between the *rGyud-bshi* and the Chinese medical literature. This question, exactly like the other one, viz. about the presence of the Greek,[11] Persian and other influences, requires a specially conscientious study.

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[10] According to some data, the changes in the text of the *rGyud-bshi* were already made by Yon-tan mGon-po senior.

With the analysis of the *rGyud-bshi* found in its existing form, we pass over to the Tibetan soil proper. Now we must come to the second main factor, without which it is impossible to think of a really exhaustive study of the theoretical part of Tibetan medicine. We are talking of the most extensive Tibetan literature of commentaries on *rGyud-bshi*. For persons not familiar with the Indo-Tibetan scientific tradition, it is to be mentioned that for every scientific discipline there exists the main "root" (Sanskrit *mula* = Tibetan *rtsa-ba*), containing the main rules, positions or aphorisms, for the most part in the form of short verses (*karika*), intended for quick committing to memory. On these main rules there are then compiled detailed commentaries and sub-commentaries in which the given theme also finds its complete development. We have such a structure in Indian mathematics, in grammatical works, in theory of poetry and in various philosophical systems as, for example, the famous aphorisms in verse of Nagarjuna's *Mula-madhyamaka-karika,* expounding the Buddhist dialectical system of Madhyamaka.

The *rGyud-bshi* is also a main text of this type, expounding the fundamental positions of medical science in the form of aphorisms in verse; the main work of Vagbhata is also exactly like that. The language of such works is extremely brief and laconic; some places just cannot be understood without a detailed commentary. Along with the usual technical terminology, an extremely difficult terminology of abridged symbols is also found. In our studies, therefore, we would have to reckon all the available elucidations and all Tibetan commentaries which could possibly be acquired. The best known amongst these commentaries is *Vaidurya-snan-po,* the work of Sans-rgyas-rgya-mtsho, also known as the regent (*sde-srid*) after the death of the Fifth Dalai Lama (1680). This work is widely used in the Tibetan medical

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11. About the translation into Tibetan language of Galen, according to the data of V.P. Vasil'ev, refer to Laufer.

schools both in Tibet herself as well as in Mongolia and Buryatia (in the Rgin and Atsagat *manba-datsan*). It is based on works which appeared after Yon-tan-mGon-po the junior. The latter himself compiled for the first time a commentary on *rGyud-bshi*, entitled *Cha-lag bCo-brgyab*. All the commentaries published after this first work cannot possibly be enumerated here. It is only necessary to mention *Mes-po-shal-lun,* the work of bLo-gros-rgyal-po, as one of the main ones. It contains incidentally the polemics with the other authorities on medicine. The author belongs to a special school, the so called Sur-har-ba, as opposed to the Northern school or system—bran-ba. A detailed study of the text would make it possible for us to ascertain what difference is there in the theories of these two systems.[12] As regards the work of Sans-rgyas-rgya-mtsho, it, based on the traditions of Sur-har-ba, contains the most complete and detailed commentary on the *rGyud-bshi*, and will be used by us in full measure in our studies. For us it is extremely important that this commentary shows a pioneering familiarity of the author with the Indian medical literature. The text of *Astanga-hrdaya-samhita* (in Tibetan: *Yan-lag-brgyad-pa'i-snin-po-bsdus-pa,* or in a short form *Snin-po-bsdus-pa*) is repeatedly quoted by him. Besides, we shall also be trying to make use of such other works for our study as would possibly be acquired. A complete list of the Tibetan medical literature associated with the *rGyud-bshi*, beginning with gyu-thog-pa the senior and the junior, in chronological order, with the indication of the names of the authors will be given by us separately. Here, however, we would consider it enough to mention the greatly acclaimed works of Darmamanramba,[13] and from amongst the modern literature, the extensive commentary *brDa-bkrol,* the work of the Mongolian physician Dandar-manramba.

Apart from this literature related, so to say, to the general course of medicine, we have numerous individual works of specialized nature. We shall here mention one called *Lhan-thabs,* compiled by Sans-rgyas-rgya-mtsho,—which is a sizeable book of practical medical treatment. Thereafter, we shall mention the specialized works on pharmacology Sel-gon and Sel-'phren, ascribed to Danjin-Puntsog of Dergess. The so called *sbyors,* that is, prescription books, also belong to this class of literature on pharmacology.

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[12] bKra-ses-rnam-rgyal, tha author of numerous works, is regarded as the most distinguished physician of the bYan-ba school.

[13] Of his works, we shall mention Man-nag-bka'-rgya-ma, the commentary on the difficult places of the third section of the *rGyud-bshi* (Man-nag-rgyud-kyi-dka'-'grel) and rDo-rje-bdud-'dul, an elucidation of the most difficult places of the fourth section of the same work (Phyi-ma'i-rgyud-kyi-dka'-gnad-rdo-rje-bdud-'dul).

Here thus is the general outline of that kind of literature which we must handle for the study of Tibetan or, more correctly, Indo-Tibetan medicine.

As we see, this is a very vast field of literature, a whole system, having more than a 2000-year antiquity. In order to really understand this system, it is necessary to study it in its entirety, taking all the available sources into account. In the analysis and translation of Sanskrit and Tibetan medical texts, the foremost attention must be paid to accurate transmission and interpretation of technical terms. The first priority must be given to precise, accurate meaning, for which we must, besides the literature, also rely upon the living oral native tradition, with whose representatives we have the rare privilege of working together. A strictly philological method, that is, the method of literal translation, is here completely unsuitable. In this case, particularly relevant and true is the view of Academician F.I. Shcherbatskoi [Th. Stcherbatsky], who frequentiy stressed that some words, though taken from the day-to-day language, do acquire the status of technical terms in a certain scientific system, and must in no way therefore be translated with their usual meaning. Just like all philosophical systems of India, or just like Indian mathematics, astronomy, political-economic teachings, grammar and theiry of poetry, the Indo-Tibetan medicine too has a definite terminology. Conveying its meaning correctly is what we must strive for in our works. The main thing is the meaning; a literal translation would always be obscure and would create completely distorted idea of the original. A.M. Pozdneev, in his translation of the first two sections of the *rGyud-bshi,* was unable to do away with the method of literal translation. The result, one has to say, was that all help given to A.M. Pozdneev by such distinguished representatives of native scientific tradition as Hambo Choinzin Iroltuev etc. turned out to be just a waste. For an illustration, a number of examples can be cited here. First of all, we shall take the translation of such an important term as *rlun*=Sanskrit *vata* or *vayu*. This word in common parlance means "wind"; but as a technical term it serves to denote energy, conditioning all motions in the organism.[14] All the available data permit us to conclude that this energy should be placed in association with the activity of the nerves, that basically it is nerve energy. But Pozdneev, under the influence of the ordinary meaning of the word ("wind"), translates the term *rlun* as "gas", obviously associating the concept of wind with the gaseous source. As a result, one gets the impression as though the Indo-Tibetan medicine regards the affection in some form or the other of kinetic properties as originating from ... a disorder in the gases. Further, the energy denoted by the term *rlun* is characterized as conditioning the cooling in organism; here is the notion of cooling at increased nerve-activity. Another cooling factor considered is what is called *bad-kan*=Sanskrit *slesman* or *kapha,* in common parlance "slime" or "phlegma", and expresses the concept of stagnant retarding source. That both these elements are regarded as conditioning the cooling, is expressed in the following form:

(Ag. ed. I, 7a, 2) rlun-dan-bad-kan-gran-ba-chu-yin-te, that is, "nerve energy and stagnant source are cooling (elements), (similar to cold) water". Pozdneev translates this place like this: "gases and slimes, in our view—are cold water" (!!!).

Lastly, the following place (page 25) is unique in its own way in its awkwardness: "in the section on diseases in the chest part of the body, the treatment is ... of head diseases, eye diseases, ear diseases, nose diseases, diseases of the mouth, forehead. There are 6 chapters in all, about the diseases in the chest part." A question automatically arises as to how the eyes, ears etc. are in the ... chest part of the body? The point is that the expression "lussted", which means the "upper part of the body" (=Sanskrit urdhvanga) has been translated hero as "chest part"; clearly, there can be no talk here of "chest". The term "*lus-stod*" is actually used sometimes in such a sense (as a part of the torso above the diaphragm), and this led to a wrong Mongolian translation *cegeji beye*, which was just rendered literally by Pozdneev, despite all common sense.[15]

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[14] This term is understood exactly like this in philosophy too. See *Abhidharmakosa* I and the commentary on it.

Any number of such examples could be cited here. It is clear that in case of such translation, one cannot look for any clarity.

From all that has been said above, it is clear that the main and fundamental criterion in our translations and studies must be: clear and correct rendering of the meaning; rejection of slavish pursuit of the letters of the text,[16] particularly when we are dealing with a specialized terminology. This can be achieved by making use all the available sources.

The translation and the study of the texts must be done with immediate participation and assistance of medical specialists. Only then would it be possible to count on a correct rendering of the concepts in the medical sense. How important this is, can be judged from the fact that often the same name of a disease is understood and translated quite differently, as for example: "me-dpal" is translated as "Anton fire" by Keresh; "herpes" by Pozdneev; and "dew" by P.A. Badmaev.

A systematic analysis of the entire literature constituting the object of our studies must be the very first stage in our work. We shall be giving a new analysis of the *rGyud-bshi* as we see it, mentioning the numeration of the folios of the Agin edition, and a fresh analysis of the commentaries and other texts indicating all the respective sections in the Sanskrit literature. A complete survey of the whole material will enable us to familiarise ourselves with the field which had long been of great interest, and to create a general idea of it. On this basis, it would then be possible to switch over to translations and research both in a systematical order as well as of some individual sections, chapters and themes, having a particularly exclusive interest.

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15. Despite common sense, one may quote also the text of the commentary *Vaidurya,* III, 96a, 4-5, where a quotation is given from *Ast.*, book 6, XIV, (p. 678) : *jatrurdhva-janam vyadhinam...*
16. It should be observed that the most of the Mongolian translations are of such slavish nature and are therefore not valuable for research.

APPENDIX IX

TANTRA, ALCHEMY AND MEDICINE

S. KALYANARAMAN

Kutumbiah underscores the close resemblance between the materia medica of ancient India and those of Egypt and Mesopotamia based on the three groups into which drugs were classified: vegetable products, animal products and mineral substances.[1] Use of mercurial preparations in the treatment of diseases and for promoting health and longevity, provides a link between alchemy and ancient medicine.

The extension of alchemy into iatro-chemistry during the medieval period of Indian history is almost entirely attributable to the tantric alchemical school. In materia medica,[2] the mineral or inorganic substances are generally classified under five groups, of which mercury is a class by itself :

rasa, mercury ;

uparasa, metallic ores and earths [sulphur, talc or mica, two types of iron pyrites called *svarna-maakshika* and *taara-maakshika*, leadstone, orpiment, realgar, sulphate of copper, sulphate of iron, cinnabar, minium or red lead, sulphuret of lead, calamine (*kharpara*), *silajatu* (a bituminous substance containing iron), alum, borax, chalk, calcined cowries and conch shells, *gairika* (a red mountain earth or ochre), *kankushta* (a mountain earth), *sauraashtri* (a fragrant earth from Surat), sand, clay, etc.] ;

dhaatu, metals (gold, silver, copper, tin, zinc, lead, iron, bell-metal and brass);

lavana, salts (*saindhava*, rock salt ; *saambara*, *sambar* lake salt ; *sauvarchala*, sonchal salt ; bit, black salt ;

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1. Kutumbiah, P., *Ancient Indian Medicine,* Bombay, Orient Langman, rev. edn, 1969, p. 111.
2. Dutt, Uday Chand, *Materia Medica of the Hindus,* 2nd edn., 1922 ; Reprint, Varanasi, Chowkhambha Saraswatibhawan, 1980, pp. 23ff.

samudra or karkach, sun-dried sea salt ; *aubhida*, a saline efflorescence on reh lands ; *pansuja*, salt obtained from saline earth ; *yavakshaara*, impure carbonate of potash ; *sarjikaakshaara*, impure carbonate of soda ; *sarvakshaara*, mixed ashes of several plants ; *narasaara*, chloride of ammonium ; *soraka*, nitrate of potash ; *tankana*, borax ; *ushara*, saline earth) ;

ratna, precious stones (*hiraka*, diamond ; *garutmat*, emerald ; *indranila*, sapphire ; *vaidurya*, lapis lazuli ; *mauktika*, pearls ; *vidruma*, corals, etc.).

Repeated references will be found to one or more of these substances in many tantric and Siddha medicine dictionaries and texts, using a variety of terms to shroud the communication in mystery.

A sulphide of mercury[3] is mentioned in the Egyptian Papyrus Ebert (*c.* 1550 B.C.).[4] Babylonians and Assyrians had considerable knowledge of mineral substances. "Mineral drugs occur frequently in recipes for diseases of the eyes, and here, as in Egypt, sulphur was used in the treatment of skin diseases. Among the chemical elements and compounds encountered in Assyrian prescriptions, we find white and black sulphur, sulphate of iron, arsenic, yellow sulphide of arsenic, arsenic trisulphide, black saltpetre, antimony, iron oxide, magnetic iron ore, sulphide of iron, pyrites, copper dust, verdigris, mercury, alum, bitumen, naptha, calcined lime and a variety of unidentified stones."[5]

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[3] Sulphide of mercury is the main ingredient of rasamrita curanam mentioned in Vrinda's *Siddha yoga* (c. 1000 A.D.) ; Vagbhata (c. 13th century A.D.) introduces his *Rasaratna Samuccaya* as the "treatise on well-tried mercurials and minerals...adapted to treatment of diseases... It will treat of mercury, minerals and metals, the extraction of the essences (active principles), liquefaction and incineration"; loc. cit. Jaggi, O.P., *Yogic and Tantric Medicine*, Delhi, Atma Ram and Sons, 1979, p. 140.

[4] Massengill, Samuel Evans, *A sketch of medicine and pharmacy*, Massengill Company, 1943, p. 16 ; loc. cit. Kutumbiah, P., *Ancient Indian Medicine*, 1969, p. 112.

[5] Sigerist, H.E., *A history of medicine*, Oxford University Press, vol. I, p. 486 ; loc. cit. Kutumbiah, P., *Ancient Indian Medicine*, 1969, p. 112.

"Metals and metallic compounds are subjected to a so-called process of purification in order to get rid of their impurities or deliterious qualities... by repeatedly heating their plates and plunging them in the following fluids, namely, oil, whey, sour conjee, cow's urine and decoction of a pulse called kulattha (dolichos uniflours).... Metals and metalic compounds are reduced to powder by various processes. The operation is called maarana, which literally means *killing or destruction of metallic character* but practically a reduction to powder, either in the metallic state, or after conversion into an oxide of sulphide."[6] The symbolism of 'killing' is the major theme in Indian iconography, and notably among the mother goddess icons.

RASAAYANA AND VAAJIKARANA: ELIXIRS OF LIFE AND VIRILITY

"Besides the drugs and prescriptions for the treatment of diseases brought about by *dhaatu-vaishamya*, Caraka describes two other classes of medicines called *rasaayana* and *vaajikarana* for the general toning up of the system of healthy persons... *Rasaayana*: These medicines are called *rasaayana* on account of their capacity to impart superior *rasa* and *dhaatu*-s. They are elixirs of life for preserving and increasing vigour, restoring youth, improving memory and preventing disease. *Vaajikarana*: These medicines are for increasing virile power and producing progeny."[7] Al-Biruni[8] (973-1048 A.D.) amplifies the definition of *rasaayana*: "an art which is restricted to certain operations, drugs, and compound medicines, most of which are taken from plants. Its principles restore health of those who were ill beyond hope, and give back youth to fading old age." Caraka gives prescriptions for "the making of *brahmya*, *amlaka*, *haritaki*, *pranakamiya rasaayana*-s and also for the preparation of the famour *chyavanaprasa*, which was supposed to be the foremost of all *rasaayana* medicine. It is said to be specially alleviative of cough and asthma. It nourishes the weak, the wounded, the old, and those that are of tender years. 38 ingredients, mostly fruits, roots and juices, were used in its preparation. In another *rasaayana*, the *brahmya*, 21 ingredients were used. These were reduced to a powder, *to which were added gold, silver, cooper and black iron*... through the use, it is said, of the *rasaayana amlaka* the rishis got back their youth and succeeded in living for many centuries, free from disease and endowed with great strength of body, of understanding and of the senses. In *Caraka Samhita* VI.1.77, a compound of herbs is advised, which, along with many other virtues, had the power of making a person invisible [cf. the feature of the *yaksha*-s to become invisible.]... In *Caraka Samhita* VI.1.80, it is said that the *rasaayana* medicines not only procure long life, but if they are taken in accordance with proper rites, a man attains the *immortal brahman*."[9]

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[6] Dutta, Uday Chand, *Materia Medica of the Hindus*, 1980, p. 24.

[7] Caraka Samhita, VI.1 ; loc. cit. Kutumbiah, P., *Ancient Indian Medicine*, 1989, p. 123.

[8] Sachau, E.C., *Alberuni's India*, Delhi, 1964 edn., i. 188.

MERCURY AND OTHER MINERALS

It would appear that Caraka[10] and Susruta do not refer to mercury in their pharmacopoeia. "Mercury, though not mentioned by Caraka and Susruta, has in later days come to be regarded as the most important medicine in the Hindu Pharmacopoeia. The Sanskrit name for mercury is *paarada*[11] and it literally means that which protects and mercury is so called because it protects mankind from all sorts of diseases. The term 'rasa' occurs in one passage in *Caraka Samhita*. It signified mercury as well as myrrh, sulphur, gold, etc. Therefore it is doubtful if Caraka meant mercury by the term *rasa*. Supposing, however, he did mean mercury, its use was at all events, in his time, confied to skin diseases only."[12] It is notable that sulphur (and not mercury) was used for skin diseases in Egypt and Mesopotamia.

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[9] Kutumbiah, P., *Ancient India Medicine,* 1969, p. 123.

[10] Dutt, U.C., *Materia Medica of the Hindus,* 1980, p. 27 : cf. a passage in Caraka on kushtha or skin disease : sarva vyaadhi vinaasanamadyaat kushthee rasanca nigruheetam ; 'reduced mercury which cures all diseases should be taken by those affected with skin-deases.'

[11] Sarangadhara,*Saravadarsana Samgraha,* Government Oriental Hindu Series, 4,202 : 'it is the quintessence of Lord Siva." *Rasarnava Kalpa of the Rudrayaamala Tantra* (c. eleventh century A.D. ; tr. Roy, Mira and Subbarayappa, B.V., *IJHS,* 2, 137, 1967) extols specific mercury preparations : "One who takes internally one tola of this mercury can transmute metals by his mere touch. Mercury is killed even by the application of his mere sweat. Like Prajaapati, he is said to enjoy a long life of a thousand year...(143-47 ; p. 71-72) This mercury when taken internally imparts deha siddha—perfection in corporeal life with the attainment of rejuvenation and prolongation of life. Use of this mercury for six months endows one with a thunder-like strong body (158-60 ; p. 72)."

Brajendranath Seal[13] cites Vasavadatta (*c.* 6th century) on a mercurial preparation : *paaradapinda iva kaaladhaatu vaadinah*, preparation of a mass of fixed or coagulated mercury [cf. Nathan Sivin's exposition on 'time-controlling substance' which parallels the *kaala-dhaatu-vaada* of Vasavadatta, i.e. the concept of quickening (artificially, using mercury, for instance) the pace of metal formation].

Varahamihira[14] devotes a chapter on *kaandarpika* (erotic remedies). To promote the possibility of the birth of a male child, he prescribes ten preparations including one with mercury : "If at the time of coitus woman's blood is in excess of male sperm, a female is born, if *vice versa*, the result is a male child ; when both the blood and sperm are equal, an hermaphrodite is born. Hence a man should take recipes enhancing his sprem . . . Tablets made of a mixture in equal proportions of the mineral compound known as *maakshika-dhaatu*, mercury (*paarada*), iron-dust, yellow myrobalan (*haritaka*) and bitumen (*silaajatu*), and then doughed with clarified butter and honey and finally done into globules (*gulikaa*), to be taken for twenty-one days."[15] The point to note is that mercury is associated with male progeny, an association consistent with other textual references equating mercury with Siva's semen etc.

Four preparations of mercury are described in *Rasendrasaara sangraha* and *Bhaavaprakaasa* : *krishna bhasma* (*rasa parpati* or *kajjali*), *sveta bhasma* (*rasakarpura*), *pita bhasma* and *rakta bhasma* (*rasa sindhura* ; red sulphide or cinnbar is called *hingula*), i.e. black, white, yellow and red purified mercury. Similar four colours are used to classify varieties of sulphur. The yellow sulphur is called *amlaa-saar*. For rheumatism or asthma and skin-diseases, a preparation called *sinhanaada guggulu* is used (composed of sulphur, bdellium, three myrobalans, castor oil boiled in an iron vessel). The use of symbols such as *sinha* or lion to connote sulphur gains added significance since the lion is also a *vaahana* or vehicle of mother goddess. The Indian trantric tradition, treats mercury as a male principle (*linga*) and sulphur as a female principle (mother goddess). Siddha medicine goes a step further and as in Tao practice, categorises many medicinal substances as either male or female.

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[12] Dutta, U.C., *Materia Medica of the Hindus,* Calcutta, Thacker Spink and Company, 1877.

[13] Seal, Brapendranath, *The Positive Sciences of the Ancient Hindus,* Delhi, Motilal Banarsidass, Reprint 1985, pp. 65ff.

[14] Varahamihira, *Brhatsamhita,* chapter 75 ; loc. cit. Shastri, Ajaya Mitra, *India as seen in the Brhatsamhita,* Delhi, Motilal Banarsidass, 1969, pp. 221ff.

[15] *Brhatsamhita,* LXXV. 1 ; LXXVI. 3.

One remarkable instance of symbolism may be cited in a preparation called *makara-dhvaja* (lit. crocodile standard or flag). This is made of leafgold, mercury, sulphur rubbed into a black mass and with the juice of red cotton flower and of aloe indica. This is subjected to sublimation in a sand-bath (*valuka yantarm*). Sulphur and mercury sublimate after nine hours and a red sublimate of shining dark red scales (red sulphide) collects below the neck of the bottle. This sublimate is called *makara-dhvaja* and administered for nervous debility, female complaints after delivery, etc. Combined with camphor, nutmegs, black pepper, musk, which are stimulants, the *makara-dhvaja* is administered as an aphrodisiac. "It is used in nervous debility, impotence, premature old age etc. *Makara-dhvaja* is regarded as a preparation of gold, which is supposed to be the active principle of the medicine. The gold used in its preparation however remains below, and mercury and sulphur only are sublimed in the form of red sulphide, as in the preparation of mercury called *rasa sindhur*. Properly speaking, therefore, it is but a preparation of mercury, although the gold may possibly exercise some catalytic influence during the process of sublimation. Some physicians use the preparation called *sadguna balijarita rasasindura* under the name of *makara-dhvaja*."[16] The symbolism and choice of name for the preparation is related to the mythology that *makara-dhvaja* is the standard of *Kaama*, the god of love. That *makara* is also the *vaahana* or vehicle of *Varuna* adds to the antiquity of the tantric medicine, since *Varuna* is the primordial symbol of the waters, *rasa* in general.

The South Indian Tantric Siddhas (10th century A.D. and

[16] Dutt, Uday Chand, *Materia Medica of the Hindus*, 1980, pp. 60-61..

later) reject Sankara's doctrine of pure illusion[17] and accept the reality of the world. Tracing their tradition to Agastya, and using a preparation called muppoo (the elixir of life), the Siddha-s believed that its potency to transmute base metals to gold can be directly applied to the human body. .

The Tamil lexicon interprets *muppu* as a medical treatise by Agastya and *muppoo* as "a salt believed to have the power of transmuting baser metals into gold, and to enable one to live 1,00,000 years", clearly a hyperbole which intends to make the point forcefully. Another interpretation in a Siddha lexicon is that *muppu* is a combination of three salts : *poo-neeru*, *navaccaaram* (ammonium chloride, sal ammoniac) and *vediyuppu* (salt petre, nitre). The *poo-neeru* is an efflorescence (white fluid) from fuller's earth which is said to occur in the months of January to March (Tamil months : *tai*, *maasi*, *panguni*).[18] The Tamil lexicon interprets *poo-neer* as water obtained from brackish soil ; and *poo-neeru* as a "light coloured earthy matter containing a great proportion of carbonate of soda, a medical powder" and more specifically, *poo-neer-uppu* or *poo-neeru-k-kaaram* as a sodae carbonas or carbonate of soda.

To highlight the link between trantrism and medicine, it is apposite to quote extensively from N.N. Bhattacharya, from his history of Tantric religion which provides hundreds of references to trantric texts and draws attention to the pioneering work done by P.C. Ray on the history of chemistry in ancient India.

"The tantric maxim that the body is the epitome of the universe is the basis of Indian medical science ; it rests on the assumption that the elements forming the body cannot be dissociated from environmental elements and that by applying laws which govern the latter, the former may be brought to order. This environmental matter, which is not different from bodily matter, is called Prakrti in the Sankhya and conceived here as the Female Principle from which everything in the world is produced. Prakrti is characterised by three qualities which influence and attract a number of forces of varying qualities and properties. These forces are conceived as Purusha-s or Male Principles, and it is only by the union of Prakrti with the Male Principles that creation starts in different spheres...

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[17] Viraraghava, K.C., in *Acharya Ray Commemoration Volume*, Calcutta, 1932, p. 460.

[18] Manickavaasagam, R., *Siddhargal Paribhashai akaraadi* (Siddha lexicon), Madras, Tirumagal Nilayam, 1982, p. 250.

"The Tantric principles appear to be more akin to the Chinese principles of Yang and Yin, symbolising the positive and negative forces, the Male and Female principles, which have found diverse applications in elaborating the theoretical principles of Chinese medicine, chemistry, music, etc. In the Tantric Rasa school of alchemy, the basic ingredients to be mixed or combined are conceived as having properties of the Female principle while the process which produces the effect, or the essence of the effect itself, as having those of the Male... in the same way as the intoxicating power of liquor is created by the combination of various ingredients in different proportions... feminine names attributed to the nerves (of 32 subtle glands) as *idaa*, *pingalaa*, *susumnaa*, *gandhaaree*, *hastijihvaa*, *pushaa*, *yasasvinee*, *alambushaa*, *sankhinee*, etc...

"Indian medical science, as revealed in the *Caraka-samhita* and *Susruta-samhita* is basically Tantric. *Although in the present form of these texts a priori ideas have been grafted, and these Brahmanical accretions are hostile to scientific understanding, the basic structure of scientific reasoning still prevails in these works* (emphasis provided)... The medical tradition of India lays the greatest emphasis on a cause-effect relation ; and it is interesting that the Buddha himself based his doctrine of suffering on the medical tradition (cf. Debiprasad Chattopadhyaya, *SSAI*, for a superb exposition on the *Caraka-samhita* and its *lokayata*, scientific foundations)...

"All the (tantric) medical texts are lost but a few of the texts on alchemy survive... there are reasons to believe that the original purpose of the Tantric *savasaadhanaa* was dissection... of the main divisions of Ayurveda... *bhutavidyaatantra* (dealing with mental diseases), *kaumaarabhrtyatantra* (dealing with diseases of children), *agadatantra* (science of toxicology), *vaajeekaranatantra* (prescription for enhancing sexual vigour etc.) and *rasaayanatantra* (science of chemical preparations needed for medicinal and other purposes)... The Tantric physicians who depended mostly on chemical drugs were known as Rasavaidyas and formed a sect of their own. *They used mainly drugs produced from mercury, mica, gold, and silver*... devised a philosophy of body in terms of its chemical reactions, known as *rasesvara-darsana* or *kaayatattva*...

"We have the names of their chief exponents Mahaadeva, Adinatha, Nityanatha, Candrasena, Gorakshanatha, Kapaali and others. The Siddha sect of the South also depended on mercurial drugs and the method of their treatment was known as *siddha-cikitsaa*. Also called Mahesvara Siddhas of the Suddhamaarga, they had as the founder of one of their subsects a Chinese Taoist named Bhoga who possessed wonderful knowledge of alchemy. The Natha Siddhas were closely allied with Rasesvara Siddhas. Each of the nine Natha Siddhas was generally held to stand at the head of a community of expert alchemists who were masters in the preparation of antidotes against old age, diseases, and poisons... Yasodhara (*Rasaprakaasa sudhaakara, c.* 11-13 century A.D.) made some substantial contribution to the metallurgy of zinc. The *Rasacintaamani* of Madanaantadeva describes the processes of the preparation of calomel, the fabrication of gold and silver, extraction of zinc from calomine, copper from blue vitriol, etc.[19] The *kaakacandesvareemata-tantra* mainly deals with mercurial preparation, copper, and liquefaction of mica[20]... *Rasaratnasamuccaya*[21] classes (minerals) under the four categories of *rasa, uparasa*, *ratna* and *loha*... *The Rasasaara* of Govindaacaarya deals with eighteen operations of mercury. It is interesting to note that the author describes his indebtness to the Buddhists of Tibet for the knowledge of certain processes..."[22]

FOCUS OF COUNTER-IDEOLOGY WAS ON AURIFICATION, NOT MEDICINE

Juxtaposed to the elaboration of medical uses of tantric alchemical experiments, the counter-ideology exemplified by the rtvij and the state-enterprise he headed in the *Arthaśastra* days to transmute copper into gold did use the skills of masons : "...the evidence of the *Mahabharata* (Adi, lxi.9ff)... The king, wanting a sacrifice to be performed, got priests (*rtvij*) to measure the place for altar-construction and employed expert Brahmins with specialised knowledge of priest-craft to construct the altar. But it was eventually found that there was some bungling about it and this bungling was detected by a mason (*sthapathi*) well-versed in architectural technology (*vaastu-vidyaa*). Thus something more than the knowledge of priest-craft was needed for altar-construction and that was the know-how of brick-makers and brick-layers."[23]

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[19] Ray, P., *HCAMI,* pp. 155, 363-65.

[20] Ray, P., *HCAMI,* pp. 150, 345-50.

[21] Ray, P., *HCAMI,* pp. 165-195, 371-403.

[22] Bhattachharya, N.N., *History of the Tantric Religion,* Delhi, Manohar Publications, 1982, pp. 16ff.

Virtually the entire ancient Indian materia medica based on mineral substances is, thus, traceable only to the plebeian alchemical tradition since the other tradition promoted by the royalty-priest alchemical consortium was busy with aurification and was governed by an ideology which treated an Ambastha, a medicine-man as an 'impure' person.

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[23] Chattopadhyaya, Debiprasad, intro., viii ; (ed.) *Mathematics in the Making in Ancient India* by G. Thibault, Calcutta, K.P. Bagchi and Co., 1984.

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ABBREVIATIONS USED : GENERAL REFERENCE WORKS, ANTHOLOGIES, JOURNALS

ACI	*Ancient Cities of the Indus,* Possehl, G.L. (ed.), New Delhi, 1979.
AV	*Atharva veda*
BSOAS	*Bulletin of the School of Oriental and African Studies,* London.
BIHM	*Bulletin of the Institute of History of Medicine* (Hyderabad), Vol. 1, 1963.
CDIAL	*A comparative dictionary of Indo-Aryan languages,* Turner, R.L., London, Oxford University Press, 1966.
DED	*Dravidian Etymological Dictionary,* Burrow, T. and Emeneau, M.B., Oxford, Clarendon Press, 2nd edn., 1984.
EH	*Excavations at Harappa,* M.S. Vats.
EIP	*Essays in Indian Proto-history,* Agrawal, D.P. and Chakrabarti, D.K. (eds.), New Delhi, 1979.
ER	*Encyclopaedia of Religion,* Mircea Eliade (ed.)
ERE	*Encyclopaedia of Religion and Ethics,* James Hastings (ed.).
FEM	*Further Excavations in Mohenjo-daro,* Mackay, E.J.
FIC	*Frontiers of the Indus Civilization* (Sir Mortimer Wheeler Commemoration Volume), Lal, B.B. and Gupta, S.P. (eds.), Delhi, 1984.
HC	*Harappan Civilization : A Contemporary Perspective,* Possehl, G.L. (ed.), Delhi, 1982.
HHC	*History of Hindu Chemistry,* Ray, Prafulla Chandra.
HCAMI	*History of Chemistry in Ancient and Mediaeval India,* P. Ray (ed.), Indian Chemical Society, Calcutta, 1956.
HSTAI	*History of Science and Technology in Ancient India,* Debiprasad Chattopadhyaya, Calcutta, Firma KLM Private Limited, 1986.
HT	*A History of Technology,* Charles Singer, E.J. Holmyard and A.R. Hall (eds.), 7 vols., Oxford, 1954.
IHQ	*The Indian Historical Quarterly,* Calcutta.
IJHM	*Indian Journal of History of Medicine,* Vol. 1, 1956. New Delhi/Madras.
LJHS	*Indian Journal of the History of Science,* Indian National Science Academy, New Delhi.

JASB	*Journal of the Asiatic Society of Bengal,* Calcutta.
JRAS	*Journal of the Royal Asiatic Society of Great Britain and Ireland.*
MASI	*Memoirs of the Archaeological Survey of India,* New Delhi.
MIC	*Mohenjo-daro and Indus civilization,* Marshall, J. (ed.), 3 3 Vols., London, 1931.
PIHC	*Proceedings of the Indian Hisotry Congress.*
Puratattva	Journal of the Indian Aachaeological Society, New Delhi.
RCIA	*Radiocarbon and Indian Archaeology,* Agarwal, D.P. and Ghosh, A. (eds.), Bombay, 1973.
RV	*Rgveda.*
SBE	*Sacred Books of the East,* Max Muller, F. (ed.), First Published 1882, Reprinted Delhi, 1972.
SHSI	*Studies in the History of Science in India,* 2 Vols., Chattopadhyaya, D. (ed.), New Delhi, 1982.
SHSIA	*Symposium on the History of Sciences in India : Abstracts of Papers,* New Delhi, Oct. 1968.
SSAI	*Science and Society in Ancient India,* Debiprasad Chattopadhyaya, Calcutta, 1979.

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DW (BPA) *Ten Suttas from* Digha Nikaya (Burma Pitaka Association, 1984), Saranath, 1987 ed.

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ERE *Encyclopaedia of Religion and Ethics.* Ed. Hastings.

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JAOS *Journal of the American Oriental Society.*

Jayanta-bhatta. *Nyayamanjari.* Benares, 1916 ed.

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